Oracle ZFS Storage Appliance Customer Service Manual

Part No: E48492
January 2014 E48492–02

Copyright © 2009-2014 , Oracle and/or its affiliates. All rights reserved.

This software and related documentation are provided under a license agreement containing restrictions on use and disclosure and are protected by intellectual property laws. Except as expressly permitted in your license agreement or allowed by law, you may not use, copy, reproduce, translate, broadcast, modify, license, transmit, distribute, exhibit, perform, publish or display any part, in any form, or by any means. Reverse engineering, disassembly, or decompilation of this software, unless required by law for interoperability, is prohibited.

The information contained herein is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

If this is software or related documentation that is delivered to the U.S. Government or anyone licensing it on behalf of the U.S. Government, the following notice is applicable:

U.S. GOVERNMENT END USERS. Oracle programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, delivered to U.S. Government end users are "commercial computer software" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, use, duplication, disclosure, modification, and adaptation of the programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, shall be subject to license terms and license restrictions applicable to the programs. No other rights are granted to the U.S. Government.

This software or hardware is developed for general use in a variety of information management applications. It is not developed or intended for use in any inherently dangerous applications, including applications that may create a risk of personal injury. If you use this software or hardware in dangerous applications, then you shall be responsible to take all appropriate fail-safe, backup, redundancy, and other measures to ensure its safe use. Oracle Corporation and its affiliates disclaim any liability for any damages caused by use of this software or hardware in dangerous applications.

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Opteron, the AMD logo, and the AMD Opteron logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

This software or hardware and documentation may provide access to or information on content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services.

Copyright © 2009-2014, Oracle et/ou ses affiliés. Tous droits réservés.

Ce logiciel et la documentation qui l'accompagne sont protégés par les lois sur la propriété intellectuelle. Ils sont concédés sous licence et soumis à des restrictions d'utilisation et de divulgation. Sauf disposition de votre contrat de licence ou de la loi, vous ne pouvez pas copier, reproduire, traduire, diffuser, modifier, breveter, transmettre, distribuer, exposer, exécuter, publier ou afficher le logiciel, même partiellement, sous quelque forme et par quelque procédé que ce soit. Par ailleurs, il est interdit de procéder à toute ingénierie inverse du logiciel, de le désassembler ou de le décompiler, excepté à des fins d'interopérabilité avec des logiciels tiers ou tel que prescrit par la loi.

Les informations fournies dans ce document sont susceptibles de modification sans préavis. Par ailleurs, Oracle Corporation ne garantit pas qu'elles soient exemptes d'erreurs et vous invite, le cas échéant, à lui en faire part par écrit.

Si ce logiciel, ou la documentation qui l'accompagne, est concédé sous licence au Gouvernement des Etats-Unis, ou à toute entité qui délivre la licence de ce logiciel ou l'utilise pour le compte du Gouvernement des Etats-Unis, la notice suivante s'applique :

U.S. GOVERNMENT END USERS. Oracle programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, delivered to U.S. Government end users are "commercial computer software" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, use, duplication, disclosure, modification, and adaptation of the programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, shall be subject to license terms and license restrictions applicable to the programs. No other rights are granted to the U.S. Government.

Ce logiciel ou matériel a été développé pour un usage général dans le cadre d'applications de gestion des informations. Ce logiciel ou matériel n'est pas conçu ni n'est destiné à être utilisé dans des applications à risque, notamment dans des applications pouvant causer des dommages corporels. Si vous utilisez ce logiciel ou matériel dans le cadre d'applications dangereuses, il est de votre responsabilité de prendre toutes les mesures de secours, de sauvegarde, de redondance et autres mesures nécessaires à son utilisation dans des conditions optimales de sécurité. Oracle Corporation et ses affiliés déclinent toute responsabilité quant aux dommages causés par l'utilisation de ce logiciel ou matériel pour ce type d'applications.

Oracle et Java sont des marques déposées d'Oracle Corporation et/ou de ses affiliés.Tout autre nom mentionné peut correspondre à des marques appartenant à d'autres propriétaires qu'Oracle.

Intel Xeon sont des marques ou des marques déposées d'Intel Corporation. Toutes les marques SPARC sont utilisées sous licence et sont des marques ou des marques déposées de SPARC International, Inc. AMD, Opteron, le logo AMD et le logo AMD Opteron sont des marques ou des marques déposées d'Advanced Micro Devices. UNIX est une marque déposée d'The Open Group.

Ce logiciel ou matériel et la documentation qui l'accompagne peuvent fournir des informations ou des liens donnant accès à des contenus, des produits et des services émanant de tiers. Oracle Corporation et ses affiliés déclinent toute responsabilité ou garantie expresse quant aux contenus, produits ou services émanant de tiers. En aucun cas, Oracle Corporation et ses affiliés ne sauraient être tenus pour responsables des pertes subies, des coûts occasionnés ou des dommages causés par l'accès à des contenus, produits ou services tiers, ou à leur utilisation.

140127@25097

Contents

Preface 9

1 **Introduction** 11
Overview 11
Introduction 11
Hardware 14
Hardware View 15
BUI 15
CLI 21
Tasks 23

2 **Hardware Maintenance** 27
Maintenance 27
Introduction 27
ZS3-2 28
ZS3-2 Hardware Overview 28
Controller Overview 29
Physical Specifications 33
Electrical Specifications 33
Acoustic Noise Emissions 34
Internal Components 34
Motherboard, Memory, and PCIe Cards 36
Optional Cable Management Arm 40
Attached Storage 41
ZS3-4 41
ZS3-4 Hardware Overview 41
Controller Overview 41

Internal Boards 44
Components 45
Attached Storage 51
ZS3-2 51
ZS3-2 CRU Maintenance Procedures 51
Prepare the Controller for Servicing Internal Components 53
Controller Replacement Tasks 56
Oracle DE2 and Sun Disk Shelf Interoperability 72
ZS3-4 73
ZS3-4 CRU Maintenance Procedures 73
Prerequisites 73
Safety Information 73
Required Tools and Information 73
Chassis Serial Number 74
Controller Replacement Tasks 74
Oracle DE2 and Sun Disk Shelf Interoperability 89
7120 90
7120 Hardware Overview 90
Chassis Overview 90
Electrical Specifications 92
Internal Components 93
Standalone Controller Configurations 98
Attached Storage 99
7320 99
7320 Hardware Overview 99
Chassis Overview 100
7320 Replaceable Components 105
7320 Single and Cluster Controller Configurations 107
7420 109
7420 Hardware Overview 109
Appliance Overview 109
Chassis 110
Internal Boards 113
Components 114
Attached Storage 120
7x20 120

7x20 CRU Maintenance Procedures 120
Prerequisites 120
Safety Information 120
Required Tools and Information 121
Chassis Serial Number 121
Controller Replacement Tasks 122
Oracle DE2 and Sun Disk Shelf Interoperability 142
Shelf 143
Disk Shelf Overview 143
Shelf 156
Disk Shelf Maintenance Procedures 156
Prerequisites 156
Safety Information 156
Electrostatic Discharge Precautions 156
Tasks 157
Faults 167
Hardware Faults 167
Cabling 168
Connecting to Attached Storage 168
Cabling 169
Connecting to Attached Storage 170
Summary of Controller Configurations 171
Maximum Controller Configurations 171
DE2 to ZS3-2/7120/7320 Standalone 171
Connecting ZS3-2/7120/7320 Standalone Controllers to Disk Shelves 171
DE2 to ZS3-2/7320 Clustered 173
Connecting ZS3-2/7320 Clustered Controllers to Disk Shelves 173
DE2 to ZS3-4/7420 Standalone 174
Connecting the ZS3-4/7420 Standalone Controller to Disk Shelves (3 HBAs) 174
DE2 to ZS3-4/7420 Clustered 176
Connecting the ZS3-4/7420 Clustered Controller to Disk Shelves (3 HBAs) 176
7120-7320 Cabling 179
Connecting 7120/7320 Standalone Controllers to Sun Disk Shelves 179
7320 Cluster Cabling 180
Connecting the 7320 Clustered Controller to Sun Disk Shelves 180
7420 Cabling 181

Connecting the 7420 Standalone Controller to Sun Disk Shelves (2 and 6 HBAs) 181
7420 Cluster Cabling 184
Connecting the 7420 Clustered Controllers to Disk Shelves (2 and 6 HBAs) 184
ZS3-2/7120/7320 with DE2 and Sun Disk Shelves 187
Connecting ZS3-2/7120/7320 Standalone Controllers to Mixed Disk Shelves 187
ZS3-2/7320 Clustered with DE2 and Sun Disk Shelves 188
Connecting ZS3-2/7320 Storage Clustered Controllers to Mixed Disk Shelves 188
ZS3-4/7420 with DE2 and Sun Disk Shelves 189
Connecting ZS3-4/7420 Standalone Controllers to Mixed Disk Shelves 189
ZS3-4/7420 Clustered with DE2 and Sun Disk Shelves 190
Connecting ZS3-4/7420 Clustered Controllers to Mixed Disk Shelves 190

3 System Maintenance 193
System 193
Introduction 193
System Disks 193
Support Bundles 194
Initial Setup 195
Factory Reset 196
Updates 196
System Updates 196
Hardware Firmware Updates 204
Rollback 206
Cluster Upgrade 208
Updating via the BUI 209
Updating via the CLI 211
Passthrough x 214
Passthrough-x Deferred Update 214
User Quotas 214
User Quotas Deferred Update 214
COMSTAR 215
COMSTAR Deferred Update 215
Triple Parity RAID 215
Triple-Parity RAID Deferred Update 215
Dedup 215

Data Deduplication Deferred Update 215
Replication 216
Replication Deferred Update 216
Received Properties 216
Received Properties Deferred Update 216
Slim ZIL 217
Introduction 217
Snapshot Deletion 217
Snapshot Deletion Deferred Update 217
Recursive Snapshots 217
Recursive Snapshots Deferred Update 217
Multi Replace 218
Multi Replace Deferred Update 218
RAIDZ Mirror 218
RAIDZ/Mirror Deferred Update 218
Optional Child Dir 218
Introduction 218
Multiple Initiator Groups per LUN 219
Introduction 219
ConfigurationBackup 219
Configuration Backup 219
Problems 224
Problems 224
Active problems display 224
Repairing problems 225
Related features 225
Logs 226
Introduction 226
BUI 228
CLI 228

Glossary 231

Preface

The *Oracle ZFS Storage Appliance Customer Service Manual* contains hardware overviews and maintenance procedures for the Oracle ZFS Storage Appliance.

This documentation is also available while using the Browser User Interface, accessible via the Help button. The appliance documentation may be updated using the System Upgrade procedure documented in the System Maintenance chapter of this book.

Who Should Use This Book

These notes are for users and system administrators who service and use the Oracle ZFS Storage Appliance.

Related Documentation

Refer to the following documentation for installation instructions, hardware overviews, service procedures and software update notes.

- Installation Guide, Analytics Guide and Administration Guide (`http://www.oracle.com/technetwork/documentation/`)

Third-Party Web Site References

Third-party URLs are referenced in this document and provide additional, related information.

Note – Oracle is not responsible for the availability of third-party Web sites mentioned in this document. Oracle does not endorse and is not responsible or liable for any content, advertising, products, or other materials that are available on or through such sites or resources. Oracle will not be responsible or liable for any actual or alleged damage or loss caused by or in connection with the use of or reliance on any such content, goods, or services that are available on or through such sites or resources.

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info or visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs if you are hearing impaired.

◆ ◆ ◆ CHAPTER 1

Introduction

Overview

Introduction

The Oracle ZFS Storage Appliance family of products provides efficient file and block data services to clients over a network, and a rich set of data services that can be applied to the data stored on the system.

Controllers

- ZS3-2
- ZS3-4
- 7120
- 7320
- 7420

Expansion Storage

- Disk Shelves

Protocols

Oracle ZFS Storage appliances include support for a variety of industry-standard client protocols, including:

- SMB
- NFS
- HTTP and HTTPS
- WebDAV
- iSCSI
- FC
- SRP
- iSER
- FTP
- SFTP

Key Features

Oracle ZFS Storage systems also include new technologies to deliver the best storage price/performance and unprecedented observability of your workloads in production, including:

- Analytics, a system for dynamically observing the behavior of your system in real-time and viewing data graphically
- The ZFS Hybrid Storage Pool, composed of optional Flash-memory devices for acceleration of reads and writes, low-power, high-capacity disks, and DRAM memory, all managed transparently as a single data hierarchy

Data Services

To manage the data that you export using these protocols, you can configure your Oracle ZFS Storage system using the built-in collection of advanced data services, including:

LICENSE NOTICE: *Remote Replication and Cloning may be evaluated free of charge, but each feature requires that an independent license be purchased separately for use in production. After the evaluation period, these features must either be licensed or deactivated. Oracle reserves the right to audit for licensing compliance at any time. For details, refer to the "Oracle Software License Agreement ("SLA") and Entitlement for Hardware Systems with Integrated Software Options."*

- RAID-Z (RAID-5 and RAID-6), mirrored, and striped disk configurations
- Unlimited read-only and read-write snapshots, with snapshot schedules
- Data deduplication
- Built-in data compression
- Remote replication of data for disaster recovery
- Active-active clustering for high availability

- Thin provisioning of iSCSI LUNs
- Virus scanning and quarantine
- NDMP backup and restore

Availability

To maximize the availability of your data in production, Oracle ZFS Storage appliances include a complete end-to-end architecture for data integrity, including redundancies at every level of the stack. Key features include:

- Predictive self-healing and diagnosis of all system hardware failures: CPUs, DRAM, I/O cards, disks, fans, power supplies
- ZFS end-to-end data checksums of all data and metadata, protecting data throughout the stack
- RAID-6 (double- and triple-parity) and optional RAID-6 across disk shelves
- Active-active clustering for high availability
- Link aggregations and IP multipathing for network failure protection
- I/O Multipathing between the controller and disk shelves
- Integrated software restart of all system software services
- Phone-Home of telemetry for all software and hardware issues
- Lights-out Management of each system for remote power control and console access

Browser User Interface (BUI)

The browser user interface

The BUI is the graphical tool for administration of the appliance. The BUI provides an intuitive environment for administration tasks, visualizing concepts, and analyzing performance data.

The management software is designed to be fully featured and functional on a variety of web browsers.

Direct your browser to the system using either the *IP address* or *host name* you assigned to the NET-0 port during initial configuration as follows: https://ipaddress:215 or https://hostname:215. The login screen appears.

The online help linked in the top right of the BUI is context-sensitive. For every top-level and second-level screen in the BUI, the associated help page appears when you click the Help button.

Command Line Interface (CLI)

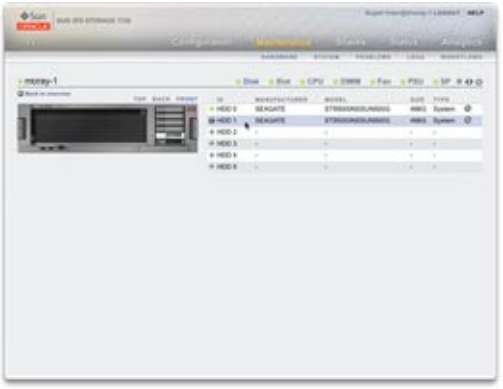
The CLI is designed to mirror the capabilities of the BUI, while also providing a powerful scripting environment for performing repetitive tasks. The following sections describe details of the CLI. When navigating through the CLI, there are two principles to be aware of:

- Tab completion is used extensively: if you are not sure what to type in any given context, pressing the Tab key will provide you with possible options. Throughout the documentation, pressing Tab is presented as the word "tab" in bold italics.
- Help is always available: the help command provides context-specific help. Help on a particular topic is available by specifying the topic as an argument to help, for example **`help commands`**. Available topics are displayed by tab-completing the help command, or by typing help topics.

You can combine these two principles, as follows:

```
dory:> help tab
builtins    commands    general     help        properties  script
```

Hardware



Locating a disk

Hardware View

The Maintenance > Hardware screen (also known as the "hardware view") provides component status of the appliance and attached disk shelves. This information is available from both the BUI and the CLI.

BUI

The BUI hardware view provides interactive illustrations that enable you to browse through the appliance and attached disk shelf components. The screenshot at the top of this page shows a disk highlighted in a Sun ZFS Storage 7320, showing both its physical location and details.

The buttons in the hardware view are:

icon	description	icon	description
	Show a more detailed view of this component		Toggle blinking of the locator LED for this component
	Leave this detailed view		Power off, reboot, or diagnostic reboot

icon	description	icon	description
	Click for more details		Offline disk
	Hardware component is ok (green)		Port active
	Hardware component is not present (grey)		Port inactive
	Hardware component is faulted (amber)		

System Overview

The main hardware page lists the system chassis, a summary of its contents, and any attached disk shelves (on supported systems). This provides an overview of the hardware present on the system. The power icon , located in the upper left of the view, presents a dialog box to either power off, reboot (power cycle), or reboot the appliance with diagnostics. Only select the diagnostic reboot option when instructed by Oracle Service personnel because it could take a long time to complete and could have adverse results if not performed properly. Do not perform a diagnostic reboot when system-affecting operations are occurring, such as upgrading firmware, executing commands, and configuring or unconfiguring storage. The diagnostic reboot option is not available when using the system chassis power icon, described below.

System Chassis

The primary system chassis is shown on the top half of the view. At the top left, click the right-arrow icon to get more detail about the chassis. The indicator notes if there are any faulted components within the chassis, and the name of the chassis. The chassis name is initially set to the appliance name during installation. To change the chassis name, use the entry field on the Configuration > Services > System Identity screen.

At the top right of the system chassis is the locate icon to light the locate LED, and the power icon , which presents a dialog box to either power off or reboot (power cycle) the appliance.

A thumbnail of the controller is presented at left. Clicking on the thumbnail or the "Show Details" link takes you to a detailed view of the chassis, and is identical to clicking on the right-pointing arrow at the top left of the view.

The following information is presented in a summary view:

Property	Description
Manufacturer	Manufacturer of the system
Model	System model name
Serial	System chassis hardware serial number
Processors	Count and description of processors in the system
Memory	Total memory in the system
System	Size and number of system disks used for the system image
Data	Size and number of data disks in the system chassis. This is only valid for standalone systems. If there are no data disks present, "-" will be displayed.
Cache	Size and number of cache disks in the system chassis. This is only valid for expandable systems that support additional disk shelves. If there are no cache disks present, "-" will be displayed.
Log	Size and number of log disks in the system chassis. This is only valid for standalone systems. If there are no log devices present, "-" will be displayed.
Total	Total size and count of all disks in the system.

Disk Shelves

A list of disk shelves, if supported, is displayed at the bottom of the view. The thumbnail to the left represents the front of the currently selected disk shelf. Clicking on the right-pointing arrow or double-clicking on a row within the list will provide complete details about the disk shelf. The state indicator will be orange if the chassis contains any faulted components. The following fields are displayed in the list:

Property	Description
Name	Name of the disk shelf, used in faults and alerts. This is initially set to the serial number of the disk shelf, but can be changed by clicking on the name within the list.
Manufacturer	Disk Shelf Manufacturer
Model	Disk Shelf Model
Data	Total size of all data disks within the disk shelf.
Cache	Total size of all read-optimized cache devices ("Readzillas") within the drive shelf. There are currently no supported disk shelves with read cache devices, but this may not always be the case. If there are no cache devices within the shelf, then "-" is displayed.

Property	Description
Log	Total size of all write-optimized cache devices ("Logzillas") within the drive shelf. If there are no log devices within the shelf, then "-" is displayed.
Paths	Total number of I/O paths to the disk shelf. The only supported configurations are those with multiple paths to all disks, so this should read "2" under normal operating circumstances. Clicking the information icon will bring up a dialog with information about each path. This includes which HBAs are connected to the disk shelf, and the state of any paths. If the disks within the disk shelf are not currently configured as part of a storage pool, complete path information will not be available, though it displays two paths to the chassis.
Locate	Toggle the locate LED for this disk shelf. If the LED is currently on, then this indicator will be flashing.

Chassis Detail

To view the chassis details, click on the right-arrow icon (or one of the alternative forms described above). This view includes some of the same controls in the upper left (state, name, locate, reset, poweroff), as well as listings of all the components in the chassis.

At the left is a set of images describing the chassis. If there are multiple views, then you can switch between them by clicking on the name of the view above the image.

For each view, faulted components will be highlighted in red. In addition, the currently selected component will be highlighted in the image. Clicking on a component within the image will select the corresponding component in the list to the right.

A tab is present for each component type in the following list. Each component type has a state icon which will be orange if there is a faulted component of the given type.

- Disk
- Slot
- CPU (controller only)
- Memory (controller only)
- Fan
- Power supply (PSU)
- Service processor (SP) (controller only)

Clicking on a component type will display a list of all physical locations within the chassis where components may be present. Clicking on a component within the list will highlight it within the appropriate chassis image. Clicking on the information icon while over a row or double-clicking a row will bring up a dialog with detailed information about the component. The information displayed in the list depends on the component type, but is a subset of the information available in the component detail. Disks and service processors support additional operations described below. Each component can report any or all of the following properties:

Property	Description
Label	Human-readable identifier for this component within the chassis. This is typically, but not necessarily, equivalent to the label printed on the physical chassis.
FMRI	Fault managed resource identifier (FMRI) for the component. This is an internal identifier used to identify the component within faults and is intended for service personnel.
Active Problems	For a faulted component, links to active problems affecting the component.
Manufacturer	Component manufacturer.
Model	Component model.
Build	Manufacturing build identifier. This is used to identify a particular location or batch where the component was manufactured.
Part	Component part number, or core factory part number. The orderable part number may differ, depending on whether a component is for replacement or expansion, and whether it's part of a larger assembly. Your service provider should be able to refer you to the appropriate orderable part. For components without part numbers, the model number should be used instead.
Serial	Component serial number.
Revision	Firmware or hardware revision of the component.
Size	Total memory or storage, in bytes.
Type	Disk type. Can be one of 'system', 'data', 'log', 'cache', or 'spare'. When a spare is active, it will be displayed as 'spare '.
Speed	Processor speed, in gigahertz.
Cores	Number of CPU cores.
GUID	Hardware global unique identifier.

Disks

Disks support the additional options:

Action	Description
Locate	Toggle the locate indicator for the disk. If the LED is currently turned on, this icon will be blinking.

Action	Description
Offline	Offline the disk. This option is only available for disks that are part of a configured storage pool (including the system pool). Offlining a disk prevents the system from reading or writing to it. Faulted devices are already avoided, so this option should only be required if a disk is exhibiting performance problems that do not result in pathological failure. It is not possible to offline a disk that would prevent access to data (i.e. offlining both halves of a mirror). If the device is an active hot spare, this will also give the option of detaching the hot spare completely. Once a hot spare is detached, it cannot be activated except through another fault or hotplug event.
Online	Online the disk. Reverses the above operation.

Infiniband Host Controller Adapters

Infiniband Host Controller Adapters (HCA) report additional properties for the list of available ports:

Action	Description
State	When "active", the active port icon is displayed. Other valid port states ("down", "init", and "arm") are denoted by the inactive port icon . Mousing over the port icon will display the current port state in the tip pop-up.
GUID	The hardware assigned port GUID.
Speed	The current port speed enabled: Single Data Rate (SDR), Dual Data Rate (DDR) or Quad Data Rate (QDR)

Service Processor

The service processor behaves differently from other component nodes. Instead of providing a list of components, it presents a set of network properties that can be configured from the storage appliance. The following properties control the behavior of the service processor network management port.

Property	Description
MAC Address	Hardware MAC address. This is read-only
IP Address Source	Either 'DHCP' or 'Static'. Controls whether DHCP should be used on the interface.
IP Address	IPv4 Address, when using static IP configuration. IPv6 is not supported.
Subnet	Dotted decimal subnet, when using static IP configuration.
Default Gateway	IPv4 default gateway address.

Changing multiple values in conflicting ways (such as changing static IP assignments while in DHCP mode) has undefined behavior.

CLI

Hardware status details are available in the CLI under the `maintenance hardware` section. Use the `show` command to list the status of all components. The `list` command will list available chassis, which can be selected and then viewed using `show`.

```
tarpon:> maintenance hardware show
Chassis:

             NAME              STATE     MANUFACTURER            MODEL

chassis-000  0839QCJ01A        ok        Sun Microsystems, Inc.  Sun Storage 7320

cpu-000      CPU 0             ok        AMD                     Quad-Core AMD Op
cpu-001      CPU 1             ok        AMD                     Quad-Core AMD Op
cpu-002      CPU 2             ok        AMD                     Quad-Core AMD Op
cpu-003      CPU 3             ok        AMD                     Quad-Core AMD Op
disk-000     HDD 0             ok        STEC                    MACH8 IOPS
disk-001     HDD 1             ok        STEC                    MACH8 IOPS
disk-002     HDD 2             absent    -                       -
disk-003     HDD 3             absent    -                       -
disk-004     HDD 4             absent    -                       -
disk-005     HDD 5             absent    -                       -
disk-006     HDD 6             ok        HITACHI                 HTE5450SASUN500G
disk-007     HDD 7             ok        HITACHI                 HTE5450SASUN500G
fan-000      FT 0              ok        unknown                 ASY,FAN,BOARD,H2
fan-001      FT 0 FM 0         ok        Sun Microsystems, Inc.  541-2068
fan-002      FT 0 FM 1         ok        Sun Microsystems, Inc.  541-2068
fan-003      FT 0 FM 2         ok        Sun Microsystems, Inc.  541-2068
fan-004      FT 1              ok        unknown                 ASY,FAN,BOARD,H2
fan-005      FT 1 FM 0         ok        Sun Microsystems, Inc.  541-2068
fan-006      FT 1 FM 1         ok        Sun Microsystems, Inc.  541-2068
fan-007      FT 1 FM 2         ok        Sun Microsystems, Inc.  541-2068
memory-000   DIMM 0/0          ok        HYNIX                   4096MB DDR-II 66
memory-001   DIMM 0/1          ok        HYNIX                   4096MB DDR-II 66
...
```

A 5th column for serial number ("SERIAL") has been truncated in the above example, as has the length of this list.

Component Properties

If a particular component is selected, detailed information about its properties are reported. The following properties are supported, with the corresponding BUI property name. For a description of a particular property, see the description above.

CLI Property	BUI Property
build	Build
cores	Cores
device	N/A
faulted	(status indicator)
label	Label
locate (writable)	(status indicator)
manufacturer	Manufacturer
model	Model
offline (writeable)	(status indicator)
part	Part
present	(status indicator)
revision	Revision
serial	Serial
size	Size
speed	Speed
type	(combined with use)
use	Type

When viewing a disk that is active as a hot spare, the `detach` command is also available.

Viewing CPU Details

For example, the following shows details for component "CPU 0":

```
tarpon:maintenance hardware> select chassis-000
tarpon:maintenance chassis-000> select cpu
tarpon:maintenance chassis-000 cpu> select cpu-000
tarpon:maintenance chassis-000 cpu-000> show
Properties:
                          label = CPU 0
                        present = true
                        faulted = false
                   manufacturer = AMD
                          model = Quad-Core AMD Opteron(tm) Processor 8356
                           part = 1002
```

```
revision = 03
   cores = 4
   speed = 2.14G
```

Restarting the Appliance

Only issue the restart command as instructed by Oracle Service personnel. This function is only available via the CLI and is not the same as a reboot (power cycle) via the BUI. The restart command is a software-only operation that restarts the management server, which could impact some client services, like replication. During execution, both the CLI and BUI are not available; wait for the appliance to return to normal operation.

Under the maintenance system context, issue the command `restart`.

```
tarpon:maintenance system> restart
```

Performing a Diagnostic Reboot

Only issue the diagnostic reboot command as instructed by Oracle Service personnel. A diagnostic reboot gathers diagnostic information before power cycling the appliance. This operation could take a long time to complete and could cause adverse results if not performed properly. Do not reboot when system-affecting operations are occurring, such as upgrading firmware, executing commands, and configuring or unconfiguring storage.

Under the maintenance system context, issue the command `diagreboot`.

```
tarpon:maintenance system> diagreboot
```

Tasks

BUI

▼ Locating a failed component

1. **Go to the Maintenance > Hardware screen.**
2. **Click the right-arrow icon on the Storage System or Disk Shelf which has the fault icon.**
3. **Locate the fault icon in the lists of hardware components, and click it. The image should be updated to show where that component is physically located.**
4. **Optionally, click the locate icon for that component, if the component has it. The LED on the component will begin to flash.**

CLI

To turn on the locate LED using the CLI, run the following commands.

Go to the maintenance hardware context:

```
hostname:> maintenance hardware
```

List the appliance components:

```
hostname:maintenance hardware> list
             NAME        STATE       MODEL             SERIAL
chassis-000  hostname    ok          Sun Storage 7320  unknown
chassis-001  000000000C  faulted     J4410             000000000C
```

Select the chassis and list its components:

```
hostname:maintenance hardware> select chassis-001
hostname:maintenance chassis-001> list
                        disk
                         fan
                         psu
                        slot
```

Select the component type and show all available disks:

```
hostname:maintenance chassis-001> select disk
hostname:maintenance chassis-001 disk> show
Disks:

          LABEL   STATE       MANUFACTURER  MODEL             SERIAL
disk-000  HDD 0   ok          ST3500630NS   ST3500630NS       9QG1ACNJ
disk-001  HDD 1   faulted     ST3500630NS   ST3500630NS       9QG1A77R
disk-002  HDD 2   ok          ST3500630NS   ST3500630NS       9QG1AC3Z
disk-003  HDD 3   ok          ST3500630NS   ST3500630NS       9QG1ACKW
disk-004  HDD 4   ok          ST3500630NS   ST3500630NS       9QG1ACKF
disk-005  HDD 5   ok          ST3500630NS   ST3500630NS       9QG1ACPM
disk-006  HDD 6   ok          ST3500630NS   ST3500630NS       9QG1ACRR
disk-007  HDD 7   ok          ST3500630NS   ST3500630NS       9QG1ACGD
disk-008  HDD 8   ok          ST3500630NS   ST3500630NS       9QG1ACG4
disk-009  HDD 9   ok          ST3500630NS   ST3500630NS       9QG1ABDZ
disk-010  HDD 10  ok          ST3500630NS   ST3500630NS       9QG1A769
disk-011  HDD 11  ok          ST3500630NS   ST3500630NS       9QG1AC27
disk-012  HDD 12  ok          ST3500630NS   ST3500630NS       9QG1AC41
disk-013  HDD 13  ok          ST3500630NS   ST3500630NS       9QG1ACQ5
disk-014  HDD 14  ok          ST3500630NS   ST3500630NS       9QG1ACKA
disk-015  HDD 15  ok          ST3500630NS   ST3500630NS       9QG1AC5Y
disk-016  HDD 16  ok          ST3500630NS   ST3500630NS       9QG1ACQ2
disk-017  HDD 17  ok          ST3500630NS   ST3500630NS       9QG1A76S
disk-018  HDD 18  ok          ST3500630NS   ST3500630NS       9QG1ACDY
disk-019  HDD 19  ok          ST3500630NS   ST3500630NS       9QG1AC3Y
disk-020  HDD 20  ok          ST3500630NS   ST3500630NS       9QG1ACG6
disk-021  HDD 21  ok          ST3500630NS   ST3500630NS       9QG1AC3X
disk-022  HDD 22  ok          ST3500630NS   ST3500630NS       9QG1ACHL
disk-023  HDD 23  ok          ST3500630NS   ST3500630NS       9QG1ABLW
```

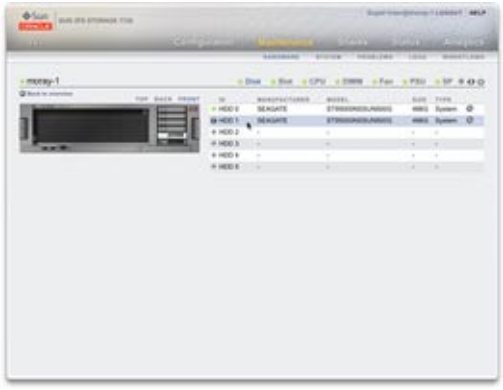
Select the faulted disk and turn on the locate LED:

```
hostname:maintenance chassis-001 disk> select disk-001
hostname:maintenance chassis-001 disk-001> set locate=true
                       locate = true (uncommitted)
hostname:maintenance chassis-001 disk-001> commit
```

◆ ◆ ◆ CHAPTER 2

Hardware Maintenance

Maintenance



Introduction

This section describes concepts and procedural instructions for performing hardware and software maintenance tasks. The graphic above illustrates locating a spare disk within the chassis by highlighting its name in the BUI Hardware Maintenance list. The Maintenance > Hardware screen of the BUI provides visual representations of the physical system components, allowing you to visually identify and locate hardware components and verify their status.

Software Updates can be applied in the System section of the interface, as well as viewing Logs and current Problems.

- Hardware Overview - identify hardware components and verify their status
- Controllers

- ZS3-2 Overview - component diagrams and specifications
- ZS3-2 Maintenance Procedures - replace controller drives, fans, power supplies, memory, cards, and batteries
- ZS3-4 Overview - component diagrams and specifications
- ZS3-4 Maintenance Procedures - replace controller drives, fans, power supplies, memory, cards, risers, and batteries
- 7120 | 7320 | 7420 Overviews - component diagrams and specifications
- 7x20 Maintenance Procedures - replace controller drives, fans, power supplies, memory, cards, risers, and batteries
- Expansion Storage
- Disk Shelf Overview - component diagrams and specifications for Oracle Storage Drive Enclosure DE2-24, and Sun Disk Shelf
- Disk Shelf Maintenance Procedures - replace disk shelf chassis components
- Connecting to Attached Storage - cabling storage controllers to the disk shelves
- Hardware Faults - Connect to ILOM to diagnose hardware faults
- System - view system disks, manage support bundles
- Updates - manage appliance software
- Configuration Backup - backup and restore appliance configuration
- Problems - view current problems
- Logs - view appliance logs
- Workflows - manage and execute workflows

ZS3-2

ZS3-2 Hardware Overview

This section describes the internal and external components of the Oracle ZFS Storage ZS3-2 controller. Use this information when preparing to service replaceable components. Refer to the following topics for procedural instructions:

- Controller Tasks - replace system controller components
- Disk Shelf Tasks - replace disk shelf components

Controller Overview

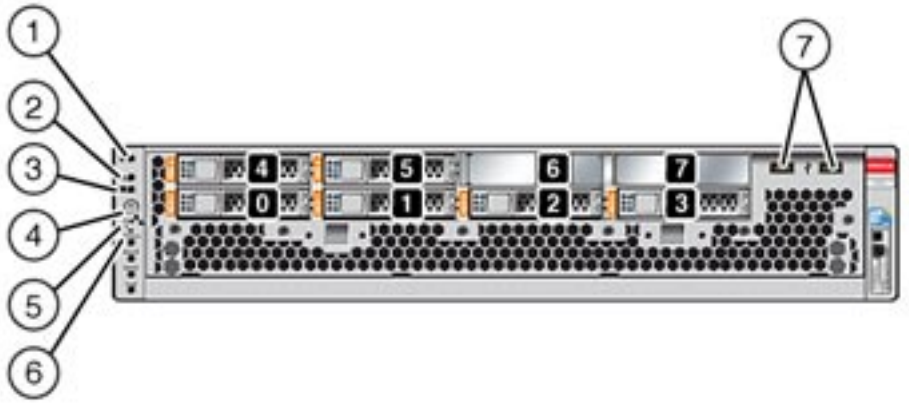
The ZS3-2 controller is an enterprise-class, rackmount x64 system powered by the Intel Xeon processor. It provides high performance and room for growth with expandable PCIe slots and 16 DIMM slots in a compact 2U footprint.

CPU	Memory	Readzilla	Boot Drive	PCIe Slots	HBA
2x8-core, 2.1GHz	256GB 16x16GB	1-4 1.6TB SAS-2 SSDs	2x2.5-inch 900GB SAS-2	2 dedicated; 4 open PCIe Options)	4-port (4x4 SAS-2) 6Gb/s external

Refer to http://www.oracle.com/us/products/servers-storage/storage/nas/overview/index.html (`http://www.oracle.com/us/products/servers-storage/storage/nas/overview/index.html`) for the most recent component specification.

Front Panel

The ZS3-2 controller drive slots and front panel components are shown in the following figure.



Drive slots 0 and 1 have two mirrored 900GB SAS-2 boot drives. Up to four 1.6TB flash read-optimized (Readzilla) solid state drives (SSDs) fill slots 2 through 5, in order. Slots 6 and 7 are empty and must contain drive fillers.

Figure Legend	
1 Locator LED/button (white)	**5** Service Processor OK LED (green)
2 Service Action Required LED (amber)	**6** Fan/CPU/Memory Service Required LED
3 Power OK LED (green)	**7** USB 2.0 ports
4 Power button	

Note: The LEDs below the Fan/CPU/Memory Service Required LED are not currently used.

Rear Panel

The ZS3-2 controller PCIe slots and rear panel components are shown in the following figure.

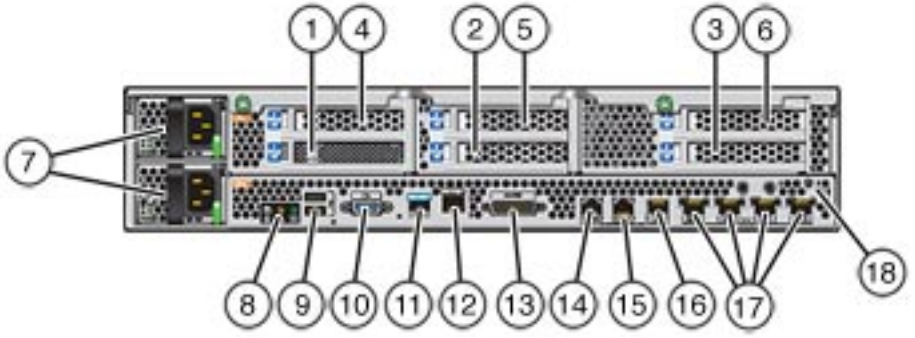


Figure Legend		
1 SAS-2 HBA (slot 1)	**7** AC power supplies PS1 (top), PS0 (bottom)	**13** Alarm port, DB-15 connector
2 4x4 SAS-2 HBA (slot 2)	**8** System status LEDs	**14-16** Cluster I/O ports
3 PCIe slot 3	**9** USB 2.0 ports	**17** 10-Gbit Ethernet ports
4 PCIe slot 4	**10** SP 15-pin VGA video port	**18** Chassis ground post
5 PCIe slot 5	**11** Serial management port	
6 PCIe slot 6	**12** Network management port	

Note:The three Cluster I/O ports (0, 1, and GigE) are reserved for cluster interconnection only.

Serial Management Connector

The serial management connector (SER MGT) is an RJ-45 port and provides a terminal connection to the service processor (SP) console.

Network Management Connector

The network management connector (NET MGT) is an RJ-45 port and provides an alternate terminal interface to the SP console.

Ethernet Ports

The ZS3-2 has four RJ-45 10-Gigabit Ethernet (10GbE) network connectors, labeled NET 3, NET 2, NET 1, and NET 0 (left to right) on the rear panel. The ports operate at 100 Mbits/sec, 1000 Mbits/sec, or 10-Gbits/sec. Use these ports to connect the appliance to the network.

The LEDs located above each NET port are Link/Activity (left) and Speed (right) indicators for each port as described in this table:

Connection Type	EEE Terminology	Speed LED Color	Transfer Rate
Fast Ethernet	100BASE-TX	Off	100 Mbits/sec
Gigabit Ethernet	1000BASE-T	Amber	1000 Mbits/sec

Connection Type	EEE Terminology	Speed LED Color	Transfer Rate
10 Gigabit Ethernet	10GBASE-T	Green	10000 Mbits/sec

Cluster I/O Ports

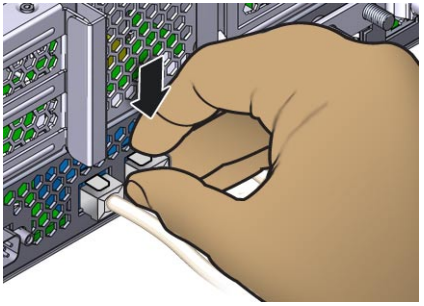
Two cluster serial ports (0 and 1) and one Ethernet port provide communication between two controllers to form a cluster configuration. For information about how to connect cables to form a cluster, see the Cluster configuration topic.

Removing RJ-45 Cables from Cluster Serial Ports

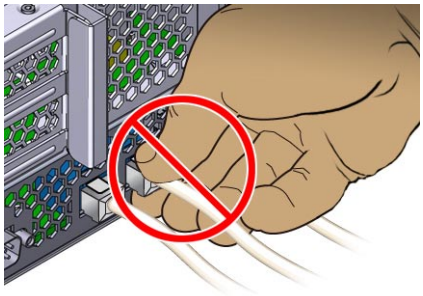
CAUTION: When disconnecting an RJ-45 cable from a cluster serial port (0 and 1), use extreme care not to damage the internal RJ-45 receptacle. To properly remove an RJ-45 cable from a cluster serial port, do the following:

1. Using your index finger, press down fully on the RJ-45 release tab.

   Be sure the tab is fully disengaged from the port.



2. Using your thumb and middle finger, apply a slight downward pressure while pulling the plug out of the port. **Do not** pull the plug upward or pinch the release tab with your fingers below the plug.



Physical Specifications

The ZS3-2 controller 2U chassis dimensions are as follows:

Dimension	Measurement	Dimension	Measurement
Height	3.44 in./87.4 mm	Depth	20.25 in./514 mm
Width	17.52 in./445 mm	Weight	41.23 lb/18.70 kg

Electrical Specifications

The ZS3-2 controller electrical specifications are listed below. The power dissipation numbers listed are the **maximum** rated power numbers for the power supply. The numbers are not a rating of the actual power consumption of the appliance.

Connectors

- Two C13 connectors which work on 110-220v outlets

Input

- Nominal frequencies: 50/60Hz (47 to 63 Hz range)
- Nominal voltage range: 100 to 120/200 to 240 VAC
- Maximum current AC RMS: 6.8 A @ 100â120 V / 3.4 A @ 200â240 V
- AC operating range: 90-264 VAC

Output

- 3.3 VDC STBY: 3.0A
- +12 VDC: 86.7A

Power Dissipation

- Max power consumption: 890 W max
- Max heat output: 3026 BTU/hr
- Volt-Ampere rating: 908 VA @ 240 VAC, 0.98P.F.

Acoustic Noise Emissions

In compliance with the requirements defined in ISO 7779, the workplace-dependent noise level of this product is less than 70 db (A).

Internal Components

The ZS3-2 chassis has the following field replaceable units (FRUs). FRUs are not customer-serviceable and must be replaced by trained Oracle service technicians.

- **PCIe Risers** - There are three risers per system, each attached to the rear of the motherboard. Each riser supports two PCIe cards (which are customer replaceable units (CRUs).
- **Motherboard** - The motherboard includes CPU modules, slots for 16 DIMMs, memory control subsystems, and the service processor (SP) subsystem. The SP subsystem controls the host power and monitors host system events (power and environmental). The SP controller draws power from the host 3.3V standby supply rail, which is available whenever the system is receiving AC input power, even when the system is turned off.
- **Power Distribution Board** - The power distribution board distributes main 12V power from the power supplies to the rest of the controller. It is directly connected to the connector break out board and to the motherboard through a bus bar and ribbon cable. It also supports a top cover interlock *kill* switch. The power supplies connect directly to the power distribution board.
- **Storage Drive Backplane** - The storage drive backplane includes the connectors for the storage drives, as well as the interconnect for the I/O board, power and locator buttons, and system/component status LEDs. The system has an 8-disk backplane. Each drive has an LED indicator for Power/Activity, Fault, and Locate.

Storage, Power, and Fan Components

The ZS3-2 controller's internal storage, power, and cooling components are described in the following figure and legend. A component identified as a field replaceable unit (FRU) must be replaced by trained Oracle service technicians.

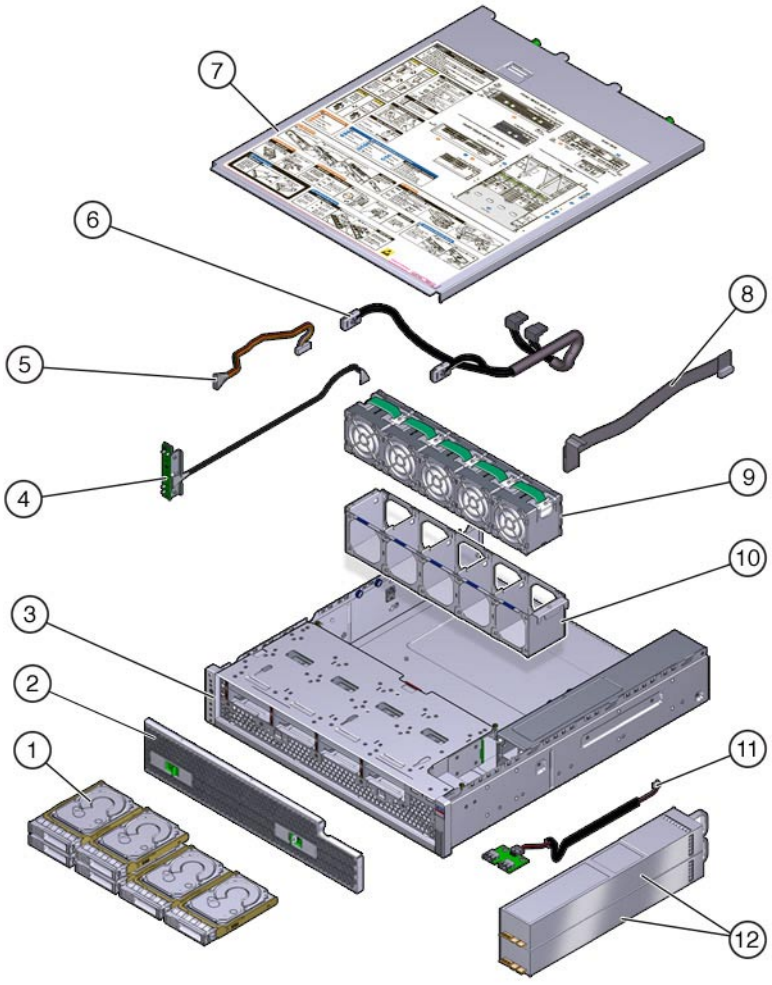


Figure Legend		
1 Drives	**5** Drive power cable (FRU)	**9** Fan modules
2 Air Filter	**6** Drive signal cable (FRU)	**10** Fan tray
3 Chassis (FRU)	**7** Top cover	**11** USB board (FRU)
4 LED board (FRU)	**8** PDB signal cable (FRU)	**12** Power supplies

Internal Cables

The ZS3-2 controller contains the following field-replaceable unit (FRU) internal cables. FRUs are not customer-serviceable, and must be replaced by trained Oracle service technicians.

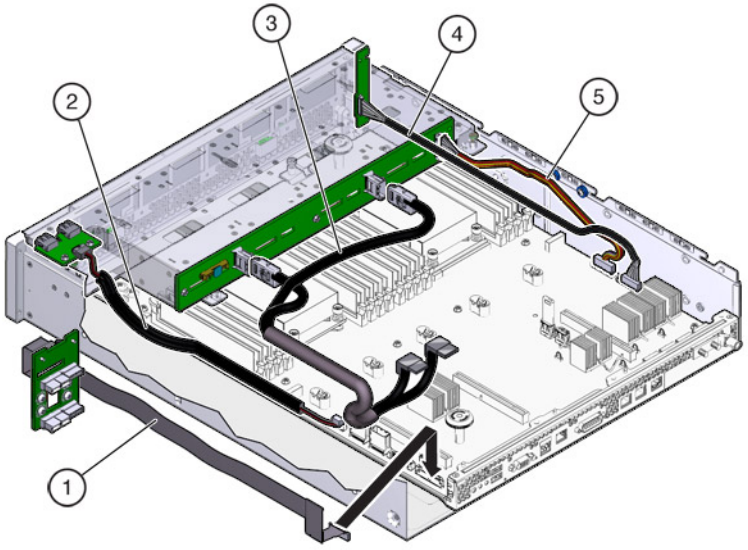


Figure Legend		
1 PDB signal cable	**3** Drive signal cable	**5** Drive power cable
2 USB board cable	**4** LED board cable	'

Motherboard, Memory, and PCIe Cards

The ZS3-2 controller motherboard, memory, and PCIe components are described in the following figure and legend.

Note: Field replaceable components (FRUs) are not customer-serviceable, and must be replaced by trained Oracle service technicians.

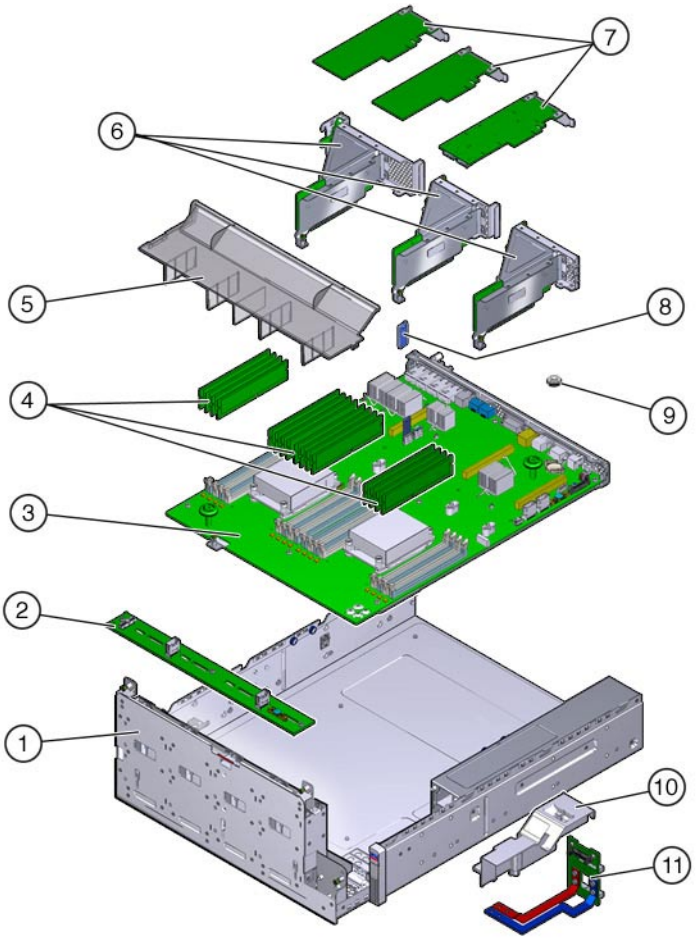
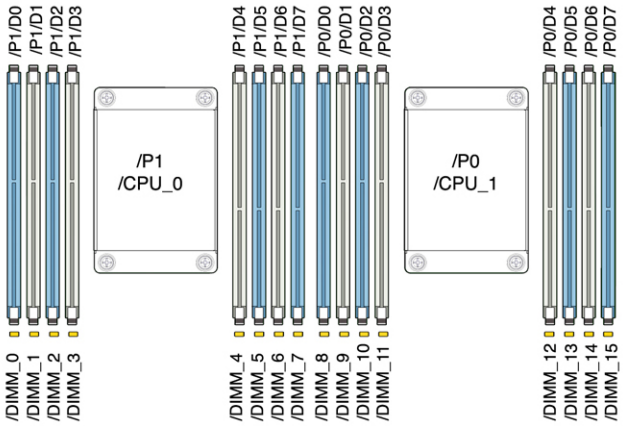


Figure Legend		
1 Drive cage (FRU)	**5** Airduct	**9** Battery
2 Drive backplane (FRU)	**6** PCIe Risers (FRU)	**10** PDB duct
3 Motherboard (FRU)	**7** PCIe cards	**11** Power distribution board (FRU)
4 DIMMs	**8** USB flash drive	

CPU and Memory

The ZS3-2 controller motherboard has 16 slots in two groups that hold industry-standard DDR3 low voltage (LV) DIMMS.



Note: All sockets must be occupied by a DDR3 DIMM or a filler. All DDR3 DIMMs must be identical.

Capacity	CPU 0	CPU 1
256GB	D0, D2, D5, D7 (blue)	D0, D2, D5, D7 (blue)
	D1, D3, D4, D6 (white)	D1, D3, D4, D6 (white)

The ZS3-2 controller replaceable memory components and part numbers are listed below.

Component	Description	FRU/CRU	Part Number
CPU	Intel E5-2658, 2.1G, 8-core	FRU	7019701
Memory	DIMM, 16GB,DDR3,1600,2Rx4,1.35V	CRU	7041603

NIC/HBA Options

The following table describes the NIC/HBA options for the ZS3-2 controller. See PCIe Options for slot allocations.

Mktg Part Number	Description
SG-SAS6-INT-Z	8-port 6Gb/s SAS-2 internal HBA
SG-XPCIE2FC-QF8-Z	2-port 8Gb FC HBA

Mktg Part Number	Description
7103791	4-port (4x4 SAS-2) 6Gb/s external HBA
X1109A-Z	2-port 10GbE SFP+ NIC
X4242A	2-port Infiniband CX2 HCA
7101674	2-port 16Gb FC/FCoE Universal HBA
7100477	4-port 1Gb Copper Ethernet UTP
7100488	2-port 10Gb Ethernet Copper Base-T
X2129A	XCVR 850NM, 1/10GPS, SFP, short reach
X5562A-Z	10GbE/1GbE SFP+ Transceiver, long reach

PCIe Riser Configuration

The three risers are labeled Riser 1, Riser 2, and Riser 3. Though similar, the risers are not interchangeable. Riser 1 installs at the left rear of the chassis, Riser 2 at the center rear, and Riser 3 at the right rear of the chassis. Each riser can accommodate two PCIe cards:

- Riser 1 contains slots 1 and 4
- Riser 2 contains slots 2 and 5
- Riser 3 contains slots 3 and 6

PCIe Options

The following table describes the supported PCIe configuration options for the ZS3-2 controller. Slots 1 and 2 are reserved for internal- and external HBAs, as shown in the following table. When adding PCIe cards, populate from higher order slots (6) first toward lower order slots. **Note:** Any empty PCIe slots must have a filler panel installed.

Slot	Mfg Part Number	Description	Max	Note
1	7047852	8-port 6Gb/s SAS-2 internal HBA	1	Base configuration
2	7067091	4-port (4x4 SAS-2) 6Gb/s external HBA	2	Base configuration
3	7067091	4-port (4x4 SAS-2) 6Gb/s external HBA	2	Second 4x4-port SAS-2 external HBA
3	7070195	4-port 1GbE copper NIC UTP	3	Optional recommended front-end
3	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)

Slot	Mfg Part Number	Description	Max	Note
3	7023303	2-port 16Gb universal FC/FCoE HBA	2	Optional FC target or initiator (backup)
3	375-3696-01	2-port InfiniBand CX2 HCA	2	Optional recommended front-end
3	7051223	2-port 10GbE optical NIC	2	Optional recommended front-end
3	7070006	2-port 10GbE copper NIC	2	Optional recommended front-end
4-6	7070195	4-port 1GbE copper NIC UTP	3	Optional recommended front-end
4-6	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)
4-6	7023303	2-port 16Gb universal FC/FCoE HBA	2	Optional FC target or initiator (backup)
4-6	375-3696-01	2-port InfiniBand CX2 HCA	2	Optional recommended front-end
4-6	7051223	2-port 10GbE optical NIC	2	Optional recommended front-end
4-6	7070006	2-port 10GbE copper NIC	2	Optional recommended front-end

Optional Cable Management Arm

The following figure identifies the components of the second-generation cable management arm (CMA). See the CMA installation instructions.

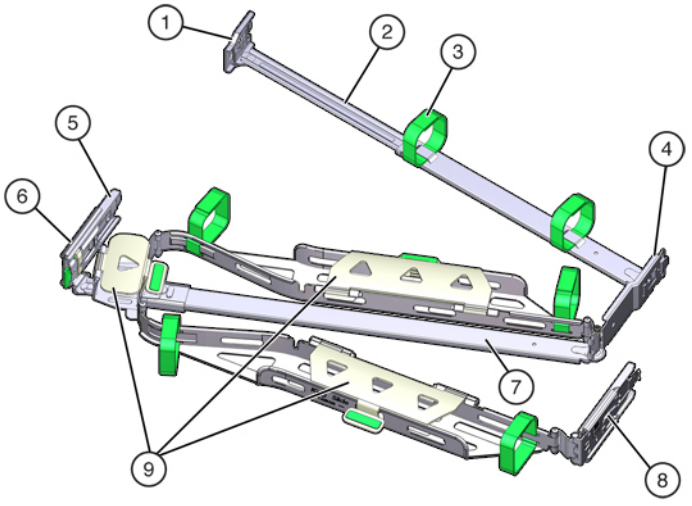


Figure Legend	
1 Connector A	**6** Connector D
2 Front slide bar	**7** Slide-rail latching bracket (used with connector D)
3 Velcro straps (6)	**8** Rear slide bar
4 Connector B	**9** Cable covers
5 Connector C	

Attached Storage

The ZS3-2 controller connects to external storage through a 4-port (4x4 SAS-2) 6Gb/s HBA. You can attach from one to eight HDD-only or SSD/HDD Logzilla-capable disk shelves to the controller. You can also attach mixed disk shelf types (DE2 and Sun Disk Shelf) in the same chain. For more information, see Connecting to Attached Storage.

ZS3-4

ZS3-4 Hardware Overview

Use the information on this page as a preparation reference for servicing replaceable components of the Oracle ZFS Storage ZS3-4 controller. Refer to the following topics for procedural instructions:

- Controller Tasks - replace system controller components
- Disk Shelf Tasks - replace disk shelf components

Controller Overview

The ZS3-4 controller can be configured as a single controller or two controllers to create a high-availability cluster configuration. The following table describes the configuration options:

Mktg Part Number	CPU	Memory	Readzilla SAS-2	Boot Drive SAS-2	HBA SAS-2	Software Version (min)
7105725	4x10-core, 2.40GHz	1TB (16GB DIMMs)	Four 1.6TB	Two 900GB	4X4-port	2013.1.0

Refer to the http://www.oracle.com/us/products/servers-storage/storage/unified-storage/index.html (`http://www.oracle.com/us/products/servers-storage/storage/unified-storage/index.html`) for the most recent component specification.

Chassis Dimensions

The ZS3-4 controller chassis fits in a standard equipment rack, and occupies three rack units (3RU) in height. The chassis dimensions are as follows:

Dimension	Measurement	Dimension	Measurement
Height	13.3 cm/5.25 in	Depth	70.6 cm/27.8 in
Width	43.7 cm/17.19 in	Weight	16.36 kg/96 lbs

Front Panel

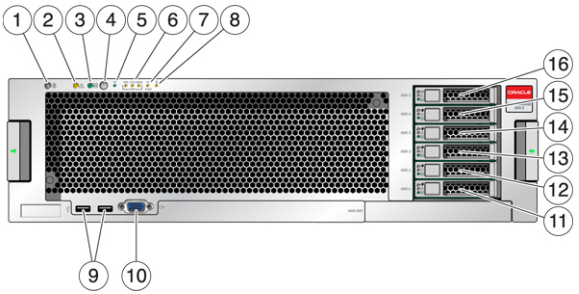


Figure Legend	
1 Locator LED and button (white)	**9** USB 2.0 Connectors
2 Service Required LED (amber)	**10** DB-15 video connector
3 Power/OK LED (green)	**11** Boot drive 0
4 Power button	**12** Boot drive 1 (required)
5 Service Processor (SP) OK LED (green)	**13** Solid state drive 2 (optional)
6 Fan/CPU/Memory Service Required LED	**14** Solid state drive 3 (optional)
7 Power Supply (PS) Service Required LED	**15** Solid state drive 4 (optional)
8 Over Temperature Warning LED	**16** Solid state drive 5 (optional)

System Drives

The ZS3-4 controller has two 900GB SAS-2 system boot drives in slots 0 and 1, configured as a mirrored pair. Up to four 1.6TB SAS-2 Readzilla SSDs can fill slots 2 through 5, in order.

Figure Legend		
1 Locate (white)	**2** Service action required (amber)	**3** OK/Activity (green)

Rear Panel

The following graphic shows the rear panel. Base configuration HBAs are not depicted in this illustration.

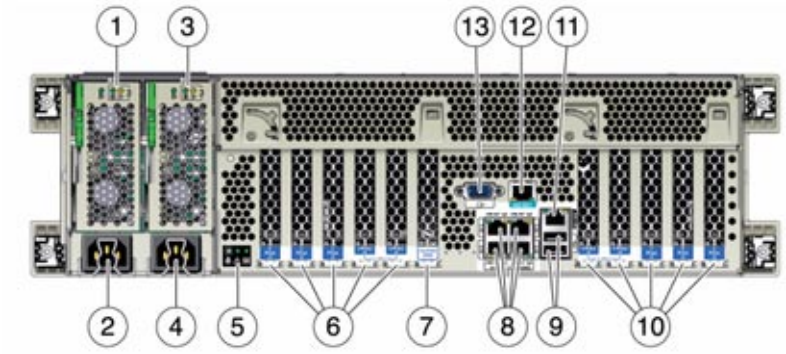


Figure Legend	
1 Power supply unit 0 status LEDs OK: green Power Supply Fail: amber AC OK: green	**8** Network (NET) 10/100/1000 ports: NET0-NET3
2 Power supply unit 0 AC inlet	**9** USB 2.0 ports
3 Power supply unit 1 status LEDs OK: green Power Supply Fail: amber AC OK: green	**10** PCIe slots 5-9
4 Power supply unit 1 AC inlet	**11** Network management (NET MGT) port
5 System status LEDs Power: green Attention: amber Locate: white	**12** Serial management (SER MGT) port
6 PCIe slots 0-4	**13** DB-15 video connector

Figure Legend
7 Cluster card slot

Electrical Specifications

The following list shows the electrical specifications for the controller.

Note: The power dissipation numbers listed are the maximum rated power numbers for the power supply. The numbers are not a rating of the actual power consumption of the appliance.

Input

- Nominal frequencies: 50/60Hz
- AC operating range: 200-240 VAC
- Maximum current AC RMS: 12A @ 200 VAC

Power Dissipation

- Max power consumption: 1800 W
- Max heat output: 6143 BTU/hr
- Volt-Ampere rating: 1837 VA @ 240 VAC, 0.98 P.F.

Internal Boards

The ZS3-4 controller chassis contains the following field-replaceable units (FRUs). FRUs are not customer-serviceable, and should only be replaced by trained Oracle service technicians.

- **Motherboard** - The motherboard includes CPU modules, slots for eight DIMM risers, memory control subsystems, and the service processor (SP) subsystem. The SP subsystem controls the host power and monitors host system events (power and environmental). The SP controller draws power from the host's 3.3V standby supply rail, which is available whenever the system is receiving AC input power, even when the system is turned off.
- **Power Distribution Board** - The power distribution board distributes main 12V power from the power supplies to the rest of the system. It is directly connected to the Vertical PDB card, and to the motherboard through a bus bar and ribbon cable. It also supports a top cover interlock ("kill") switch. In the controller, the power supplies connect to the power supply backplane which connects to the power distribution board.
- **Vertical PDB Card** - The vertical power distribution board, or Paddle Card serves as the interconnect between the power distribution board and the fan power boards, hard drive backplane, and I/O board.
- **Power Supply Backplane Card** - This board connects the power distribution board to power supplies 0 and 1.
- **Fan Power Boards** - The two fan power boards are FRUs and carry power to the controller fan modules. In addition, they contain fan module status LEDs and transfer I2C data for the fan modules.

- **`Drive Backplane`** - The six-drive backplane includes the connectors for the drives, as well as the interconnect for the I/O board, Power and Locator buttons, and system/component status LEDs. Each drive has an LED indicator for Power/Activity, Fault, and Locate.

Components

The components of the ZS3-4 controller are shown in the following figure and identified in the legend.

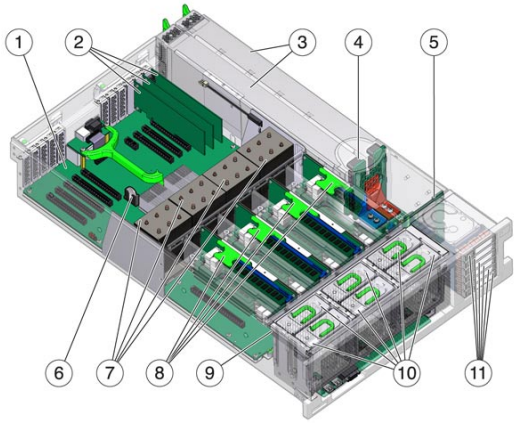
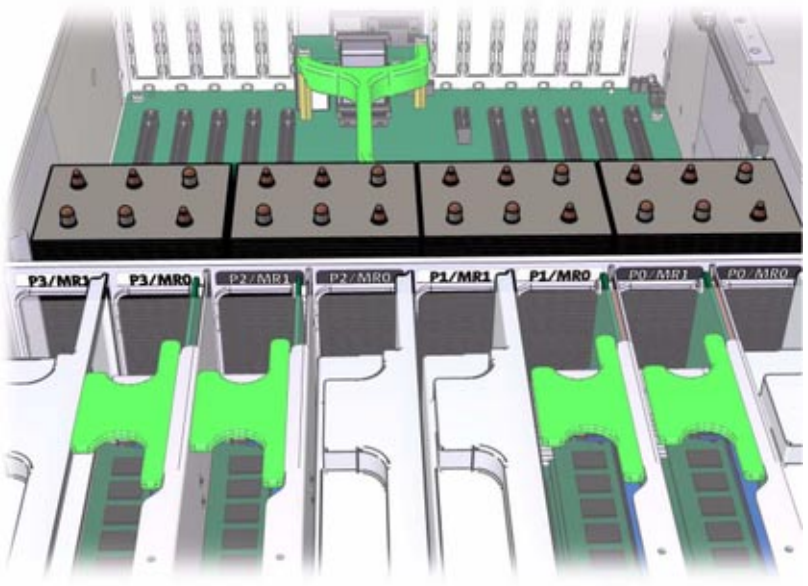


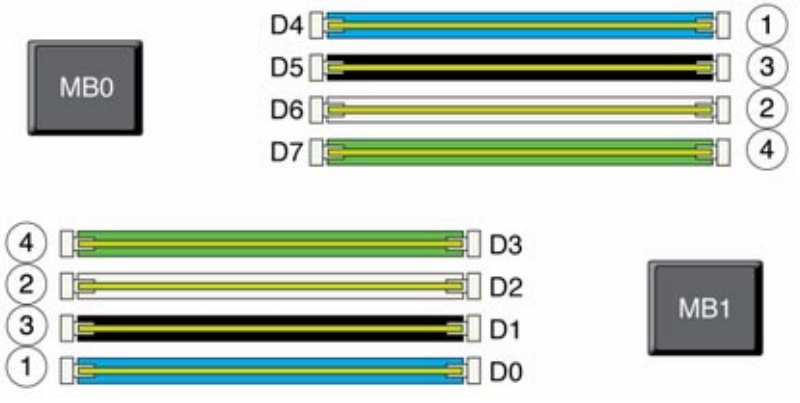
Figure Legend	
1 Motherboard	**7** CPUs and heatsinks
2 Low-profile PCIe cards	**8** Memory risers
3 Power supplies	**9** Fan board
4 Power supply backplane	**10** Fan modules
5 Drive backplane	**11** Boot drives and SSDs
6 System lithium battery	

CPU and Memory

The ZS3-4 controller supports 16GB DDR3 DIMMs installed on all eight risers, accommodating 1TB of memory.



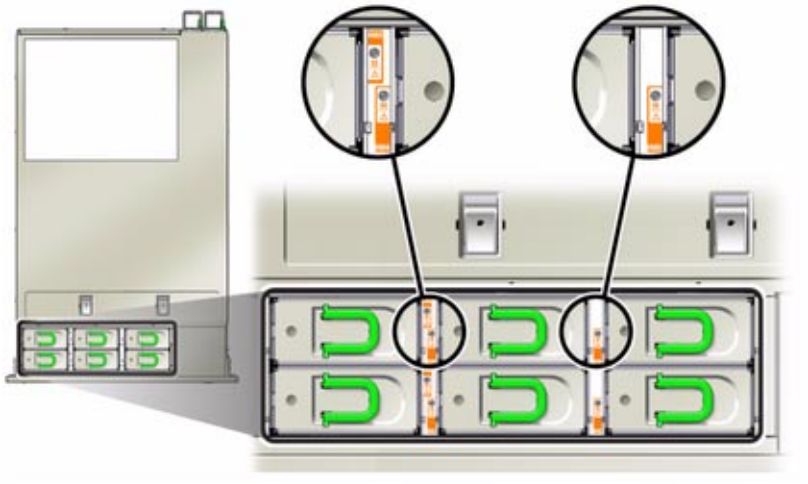
Refer to the service label on the cover for DIMM placement information. On every memory riser, slots D0, D2, D4, and D6 must be populated; optionally, slots D1, D3, D5, and D7 may be populated as a group on **all** installed memory risers. All DIMMs in the system **must be identical**.



DIMM names in appliance logs and the Maintenance > Hardware view are displayed with the full name, such as /SYS/MB/P0/D7.

Fan Modules

The Fan Modules and Fan Module LEDs of the controller are shown in the following figure. The following LEDs are lit when a fan module fault is detected:



- Front and rear Service Action Required LEDs
- Fan Module Service Action Required (TOP) LED on the front of the server
- Fan Fault LED on or adjacent to the faulty fan module

The system Overtemp LED might light if a fan fault causes an increase in system operating temperature.

NIC/HBA Options

This table describes NIC/HBA PCIe card options for ZS3-4 standalone and cluster configurations.

Mktg Part Number	Description
SG-SAS6-INT-Z	8-port 6Gb/s SAS-2 internal HBA
SG-XPCIE2FC-QF8-Z	2-port, 8Gb FC HBA
7103791	4-port (4x4 SAS-2) 6Gb/s external HBA
7100477	4-port 1Gb Ethernet Copper UTP

Mktg Part Number	Description
7100488	2-port 10Gb Ethernet Copper Base-T
X4242A	2-port Infiniband CX2 HCA
X1109A-Z	2-port 10GbE SFP+ NIC
X2129A	Transceiver 850NM, 1/10GPS, Short Reach, SFP
X5562A-Z	Transceiver 10GbE/1GbE, Long Reach, SFP

Connectors

The serial management connector (SER MGT) is an RJ-45 connector and provides a terminal connection to the SP console.

The network management connector (NET MGT) is an RJ-45 connector and provides a LAN interface to the SP console.

There are four RJ-45 Gigabit Ethernet connectors (NET0, NET1, NET2, NET3) located on the motherboard that operate at 10/100/1000 Mbit/sec. These network interfaces must be configured before use.

PCIe Options

This table describes the PCIe base configuration and optional slot assignments for ZS3-4 standalone and cluster configurations.

Slot	Mfg Part Number	Description	Max	Note
0	7047852	8-port 6Gb/s SAS-2 internal HBA	1	Base configuration

Slot	Mfg Part Number	Description	Max	Note
1	7067091	4-port (4x4 SAS-2) 6Gb/s SAS-2 external HBA	4	Base configuration
2	7067091	4-port (4x4 SAS-2) 6Gb/s SAS-2 external HBA	4	Additional optional back-end
2	7070006	2-port 10GbE copper NIC	4	Optional recommended front-end
2	375-3696-01	2-port Infiniband CX2 HCA	4	Optional recommended front-end
2	7070195	4-port 1GbE copper NIC UTP	4	Optional recommended front-end
2	7051223	2-port 10GbE optical NIC	6	Optional recommended front-end
2	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)
3	7070006	2-port 10GbE copper NIC	4	Optional recommended front-end
3	375-3696-01	2-port Infiniband CX2 HCA	4	Optional recommended front-end
3	7070195	4-port 1GbE copper NIC UTP	4	Optional recommended front-end
3	7051223	2-port 10GbE optical NIC	6	Optional recommended front-end
3	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)
4	7070006	2-port 10GbE copper NIC	4	Optional recommended front-end
4	375-3696-01	2-port Infiniband CX2 HCA	4	Optional recommended front-end
4	7070195	4-port 1GbE copper NIC UTP	4	Optional recommended front-end
4	7051223	2-port 10GbE optical NIC	6	Optional recommended front-end
4	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)
C	511-1496-05	Cluster Controller 200	1	Cluster base configuration

Slot	Mfg Part Number	Description	Max	Note
5	7070006	2-port 10GbE copper NIC	4	Optional recommended front-end
5	375-3696-01	2-port Infiniband CX2 HCA	4	Optional recommended front-end
5	7070195	4-port 1GbE UTP Ethernet	4	Optional recommended front-end
5	7051223	2-port 10GbE optical NIC	6	Optional recommended front-end
5	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)
6	7070006	2-port 10GbE copper NIC	4	Optional recommended front-end
6	375-3696-01	2-port Infiniband CX2 HCA	4	Optional recommended front-end
6	7070195	4-port 1GbE copper NIC UTP	4	Optional recommended front-end
6	7051223	2-port 10GbE optical NIC	6	Optional recommended front-end
6	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)
7	7067091	4-port (4x4 SAS-2) 6Gb/s external HBA	4	Additional optional back-end
7	371-4325-02	2-port 8Gb FC HBA	4	Optional recommended front-end
7	375-3696-01	2-port Infiniband CX2 HCA	4	Optional recommended front-end
7	7051223	2-port 10Gb Optical Ethernet	6	Optional recommended front-end
7	7070195	4-port 1GbE copper NIC UTP	4	Optional recommended front-end
7	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)
8	7067091	4-port (4x4 SAS-2) 6Gb/s external HBA	4	Base configuration

Slot	Mfg Part Number	Description	Max	Note
9	371-4325-02	2-port 8Gb FC HBA	4	Optional FC target or initiator (backup)
9	7070006	2-port 10Gb copper Ethernet	4	Optional recommended front-end
9	7070195	4-port 1GbE copper NIC UTP	4	Optional recommended front-end
9	7051223	2-port 10GbE optical NIC	6	Optional recommended front-end

Attached Storage

The ZS3-4 single and cluster controller configurations allow one to six chains of 1 to 6 disk shelves. Any combination of disk-only and Logzilla-capable shelves may be combined within the chain in any order. The cabling configurations are unchanged.

See Disk Shelf Overview for component specifications and diagrams.

ZS3-2

ZS3-2 CRU Maintenance Procedures

This section provides instructions on how to replace customer replaceable components (CRUs) in the Oracle ZFS Storage ZS3-2 controller.

Refer to Disk Shelf Procedures for replacing disk shelf components.

Prerequisites

- Read the ZS3-2 Overview section to become familiar with the replaceable parts of the system.
- Follow the instructions in the Safety Information and Required Tools and Information sections.

Safety Information

This section contains safety information that you must follow when servicing the storage system. For your protection, observe the following safety precautions when setting up your equipment:

- Do not remove the side panels, or run the storage system with the side panels removed. Hazardous voltage is present that could cause injury. The covers and panels must be in place for proper air flow to prevent equipment damage.
- Follow all cautions, warnings, and instructions marked on the equipment and described in Important Safety Information for Oracle's Hardware Systems included with your system.
- Ensure that the voltage and frequency of your power source match the voltage inscribed on the electrical rating label.
- Follow the electrostatic discharge safety practices. Electrostatic discharge (ESD) sensitive devices, such as PCI cards, HDDs, SSDs, and memory cards, require special handling. Circuit boards and HDDs contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Do not touch the components without using antistatic precautions, especially along the connector edges.

Required Tools and Information

The following tools are needed to service the CRUs:

- Antistatic wrist strap - Wear an antistatic wrist strap and use an antistatic mat when handling components such as HDDs or PCI cards. When servicing or removing storage controller components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Following this practice equalizes the electrical potentials between you and the storage controller.
- Antistatic mat - Place static-sensitive components on an antistatic mat.
- No. 2 Phillips screwdriver
- Nonconducting, No.1 flat-blade screwdriver or equivalent
- Nonconducting stylus or pencil (to power on the storage controller)

Chassis Serial Number

To obtain support for your storage controller or to order new parts, you need your chassis serial number. You can find a chassis serial number label on the storage controller front panel on the left side. Another label is on the top of the storage controller. Alternatively, click the Oracle logo in the BUI masthead to obtain the serial number or issue the following command:

```
hostname: maintenance hardware show
```

Prepare the Controller for Servicing Internal Components

ZS3-2 Prepare the Controller for Servicing Internal Components

Remove Power

Removing fan modules, memory, PCIe cards, DIMMs, and USB are cold-service operations. You **must** shut off power from the appliance before you remove any of these components.

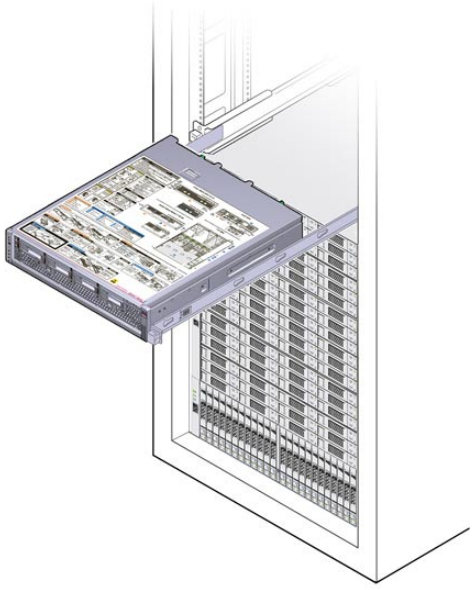
Note that there will be a loss of access to the storage unless the system is in a clustered configuration. Shut down the appliance using one of the following methods:

- Log in to the BUI and click the power icon on the left side of the masthead.
- SSH into the storage system and issue the **maintenance system poweroff** command.
- SSH or serial console into the service processor and issue the **stop /SYS** command.
- Use a pen or non-conducting pointed object to press and release the Power button on the front panel.
- To initiate emergency shutdown, wherein all applications and files will be closed abruptly without saving, press and hold the power button for at least four seconds until the Power/OK status indicator on the front panel flashes, indicating that the storage controller is in standby power mode.

Extend the Storage Controller From the Rack

1. Disconnect the AC power cords from the rear panel of the storage controller.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.

4. While squeezing the slide release latches, slowly pull the storage controller forward until the



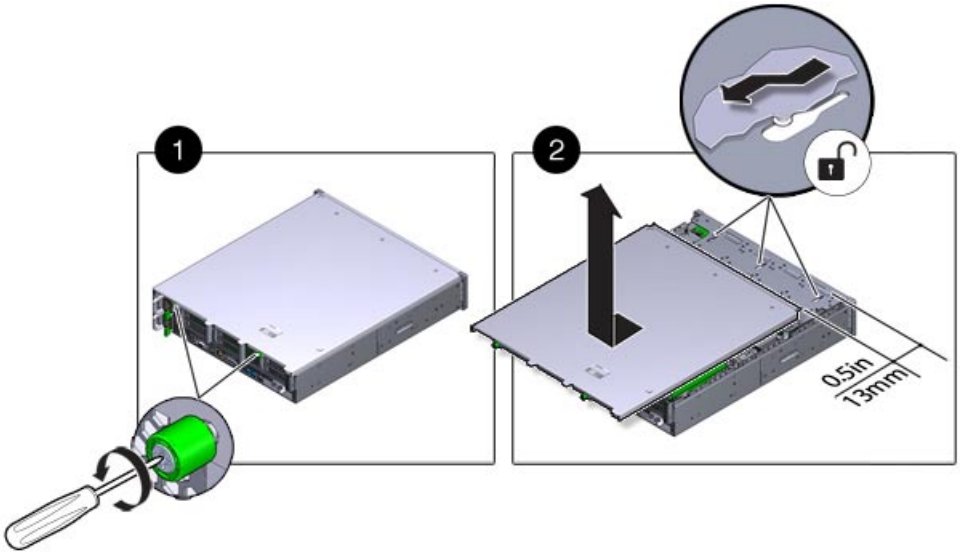
slide rails latch.

Remove the Top Cover and Air Filter

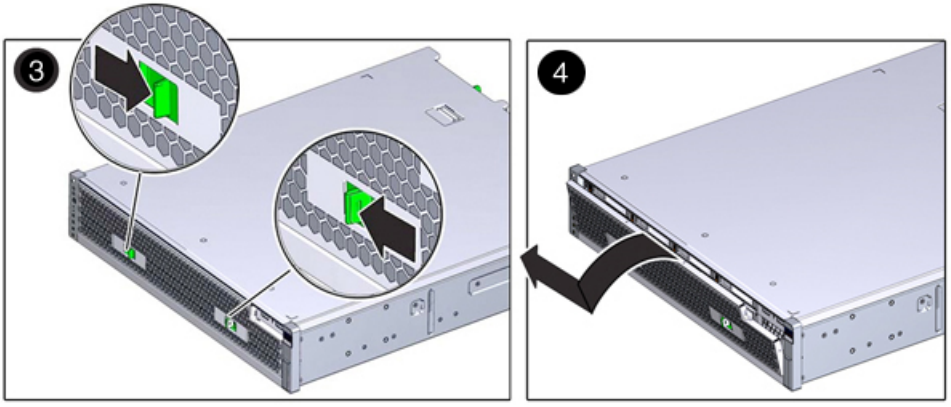
To access internal controller components for servicing, you must remove the top cover.

1. Fully loosen the two captive screws at the rear of the top cover (1).

2. Slide the top cover rearward 0.5 in (13 mm) and lift it straight up and off the chassis (2), and set the top cover aside.



3. Pinch the left and right release levers inward (3).
4. Pivot the air filter forward and lift if out of the chassis (4).

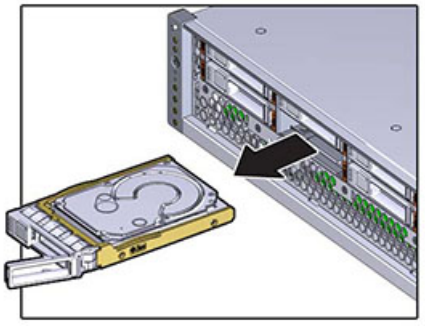


Controller Replacement Tasks

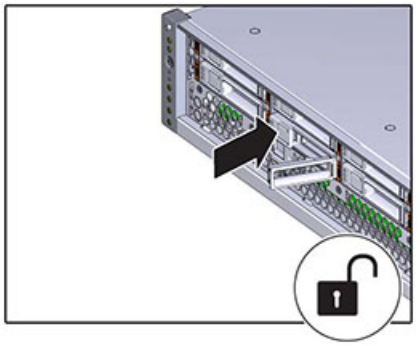
ZS3-2 Controller Replacement Tasks

SSDs and HDDs

1. Identify the failed drive by going to the Maintenance > Hardware section of the BUI and clicking the drive details icon . If you are physically at the system, the amber Service Required indicator on the HDD or SSD should be illuminated.
2. If you are not physically at the system, turn on the locator indicator by clicking the locator icon .
3. Press the release button and pivot the release lever open to the right.

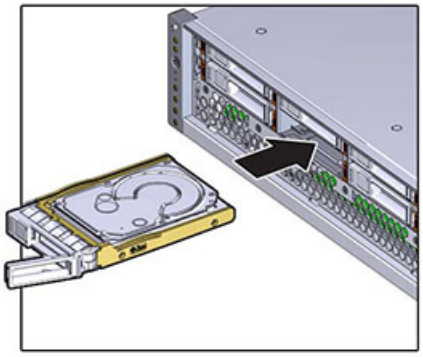


4. Grasp the release lever and pull the drive out of the drive slot.

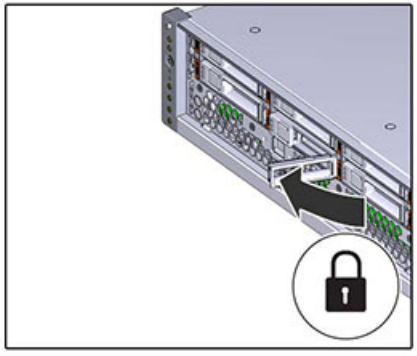


5. After 15 seconds, navigate to the Hardware > Maintenance screen, and click the details icon on the system controller to verify that the software has detected that the drive is not present.
6. Align the replacement drive with the drive slot.

7. Press on the release button to slide the drive into the chassis until the release lever moves slightly inward.



8. Press the release lever fully closed with a click, securing the drive into the drive slot.



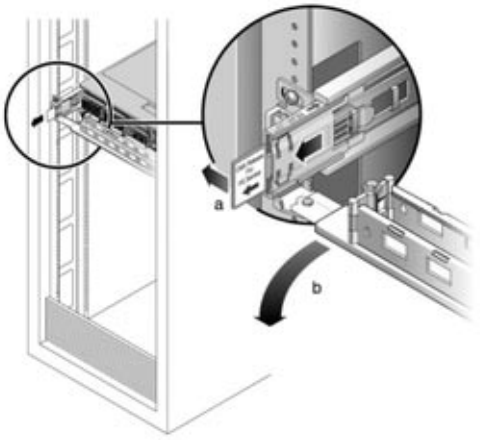
The Oracle ZFS Storage system software automatically detects and configures the new drive. The device appears in the BUI Maintenance > Hardware screen when you view details for the controller or drive shelf.

Power Supplies

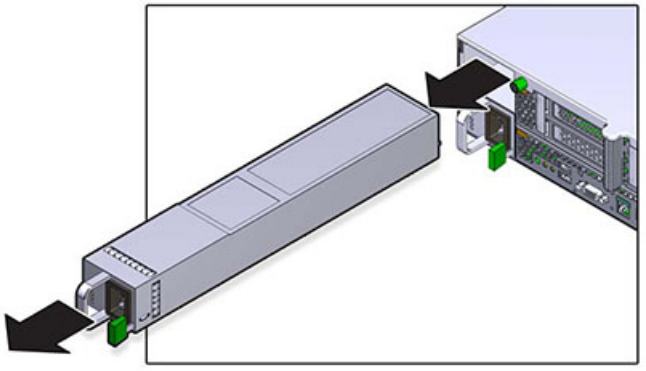
Storage controllers are equipped with redundant hot-swappable power supplies. If a power supply fails and you do not have a replacement, leave the failed power supply installed to ensure proper air flow. A faulted power supply is indicated by an amber colored status LED.

1. Gain access to the rear of the storage controller where the faulted power supply is located.

2. If a cable management arm (CMA) is installed, press and hold the CMA release tab and

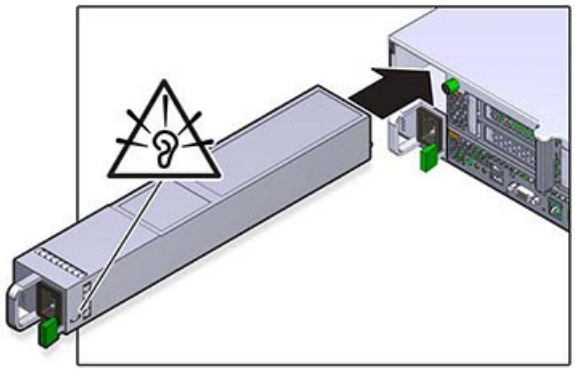


   rotate the arm out of the way.
3. Disconnect the power cord from the faulted power supply.
4. Press the release tab to the left and pull on the handle.
5. Continue to pull on the handle to slide the power supply out of the chassis.



6. Align the replacement power supply with the empty power supply chassis bay.

7. Slide the power supply into the bay until the power supply seats and the release tab clicks.



8. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.
9. Connect the power cords to the power supplies.
10. Verify that the green AC Present status indicator is lit.
11. Close the CMA, inserting the CMA into the rear left rail bracket.
12. Go to the Maintenance > Hardware screen of the BUI. Click details icon for the controller and then click power supply to verify that the status icon is green for the newly installed power supply.

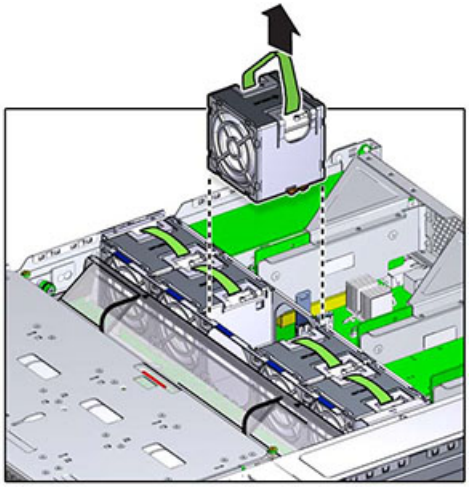
Fan Modules

Removing a fan module is a cold-service operation. You **must** power off the appliance before you remove the fan module. There will be a loss of access to the storage unless the system is in a clustered configuration.

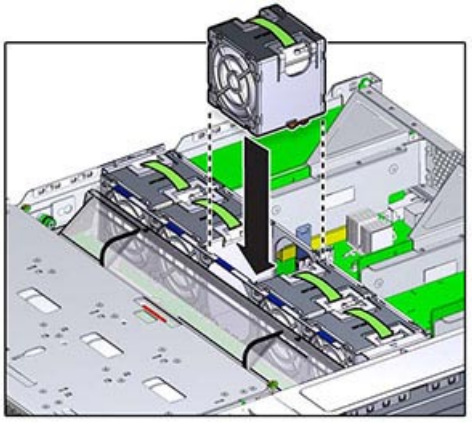
The status of each fan module is represented by a single bi-color LED. The LEDs are located on the motherboard near each fan module, and are visible from the rear panel, by looking through the grille below the risers.

1. To locate the chassis you want to service, click the associated locate icon on the Maintenance > Hardware screen of the BUI or issue the **`set /SYS/LOCATE status=on`** command at the service processor (SP) prompt. The locate LED will flash on the controller chassis.
2. Identify the faulted fan module by locating the corresponding Service Required status indicator or by clicking the locate icon on Maintenance > Hardware screen of the BUI for the fan you want to replace.
3. Power off the storage controller.
4. Extend the storage controller from the rack.
5. Remove the top cover and air filter.

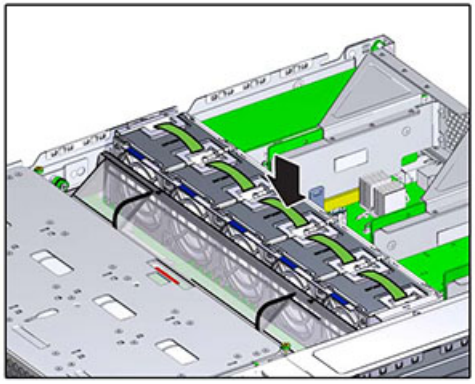
6. Grasp the green band of the fan module to be removed with your forefinger and press down on the fan module with your thumb.
7. Pull the band straight up and lift the fan module out of the chassis.



8. Align the replacement fan module into the fan tray slot. The green band is on the top of the fan module and the arrow points to the rear of the chassis.



9. Lower the fan module into the fan tray and press down until the module clicks securely in the fan tray.



10. Replace the top cover.
11. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.
12. Connect the power cords to the power supplies.
13. Use a pen or other pointed object to press and release the recessed Power button on the storage controller front panel.
14. Verify that the Fan OK status indicator is lit, and that the fault status indicator on the replaced fan module is dim.

Memory

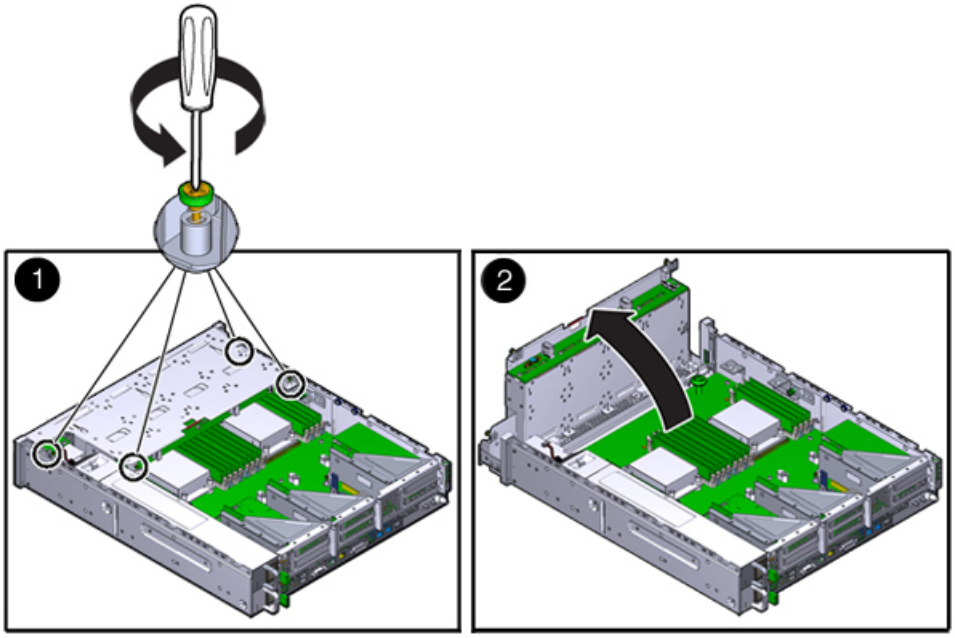
Removing a DIMM is a cold-service operation. You **must** power off the appliance before you remove the DIMM. There will be a loss of access to the storage unless the system is in a clustered configuration.

To identify a general memory fault, go to the Maintenance > Hardware screen of the BUI, and click on the details icon on the controller. Then click DIMMs to locate the faulted component, indicated by the warning icon . To identify a specific memory module that has faulted, you must open the storage controller and use the amber status LEDs on the motherboard.

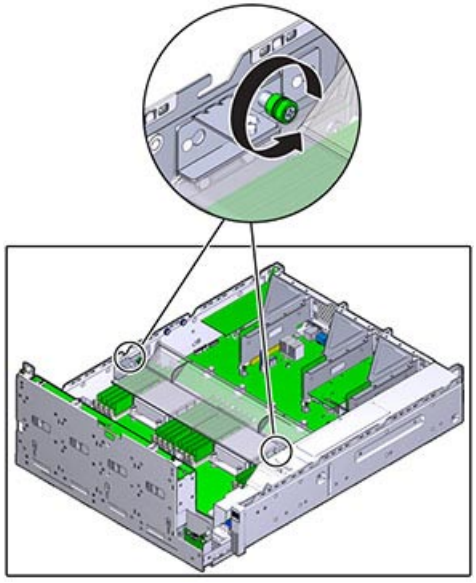
Caution: This procedure requires that you handle components that are sensitive to static discharge, which can cause the component to fail. To avoid damage, wear an antistatic wrist strap and use an antistatic mat when handling components.

1. Power off the storage controller.
2. Extend the storage controller from the rack.
3. Remove the top cover and air filter.

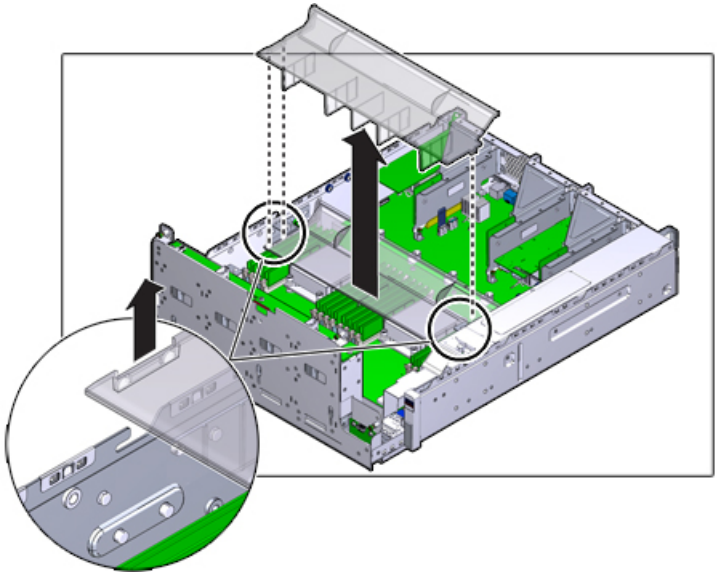
4. Disconnect the cables attached to the drive backplane, and the cable attached to the USB board.
5. Fully loosen the four screws securing the drive cage to the chassis (1).
6. Raise the drive cage to the vertical position (2).



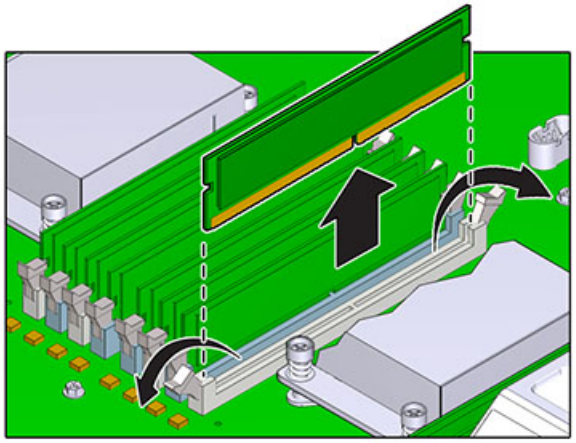
7. Fully loosen the thumbscrews that secure the air duct.



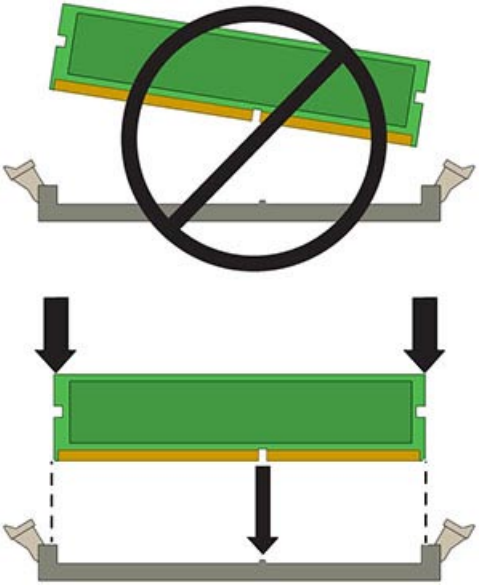
8. Slide the left (L) thumbscrew bracket forward and off of the mounting pins.
9. Slide the right (R) thumbscrew bracket rearward and off the mounting pins. Set the thumbscrew bracket aside.
10. Lift the air duct straight up and off the alignment pins. Set the air duct aside.



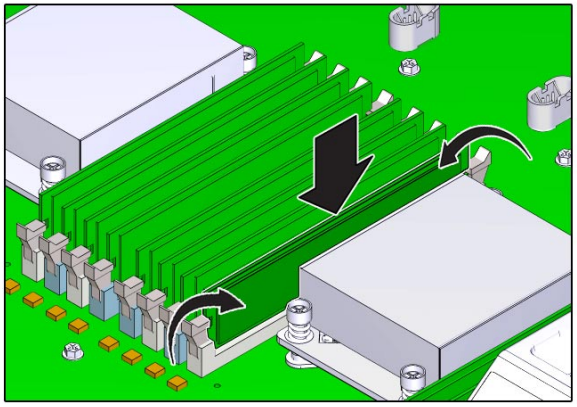
11. Press the button on the midplane. An amber LED indicates the faulty DIMM.
12. Press down and out on the release levers at both ends of the DIMM slot.
13. Lift the DIMM up and out of the slot. Set the DIMM aside on an antistatic mat.



14. Open the release levers of the slot where you are installing the DIMM.
15. Align the DIMM to the location where it installs into the slot. Ensure that the notch in the DIMM lines up with the key in the slot.



16. Insert the DIMM into the slot, pressing firmly so that both release levers click closed.



17. Lower the drive cage to the horizontal position, tighten the four screws, and reconnect the cables to the drive backplane, and the cable attached to the USB board.
18. Replace and secure the air duct.
19. Replace the top cover.
20. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.
21. Connect the power cords to the power supplies.
22. Verify that standby power is on, indicated by the Power/OK status indicator flashing on the front panel about two minutes after the power cords are plugged in.
23. Use a pen or other pointed object to press and release the recessed Power button on the storage controller front panel.

The Power/OK status indicator next to the Power button lights and remains lit. The Maintenance > Hardware screen of the BUI provides status of the replacement on the Details page for DIMMs.

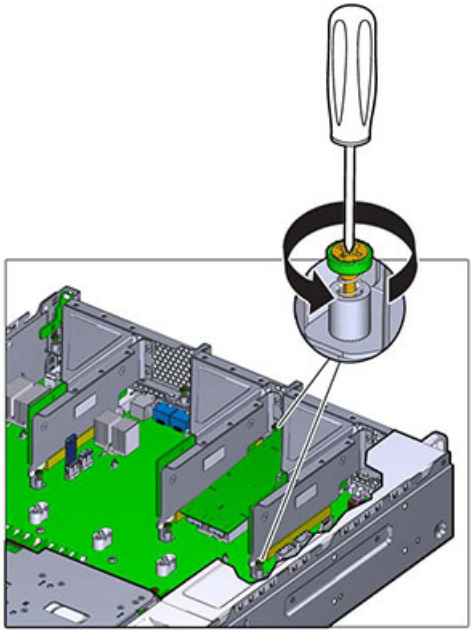
PCIe Cards

Removing a PCIe card is a cold-service operation. You **must** power off the appliance before you remove the card. There will be a loss of access to the storage unless the system is in a clustered configuration.

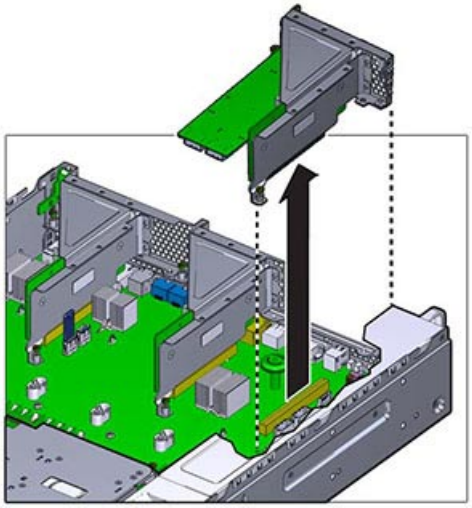
Go to the Maintenance > Hardware screen of the BUI and click the details icon on the controller, and then click Slots to locate the faulted component.

Caution: This procedure requires that you handle components that are sensitive to static discharge, which can cause the component to fail. To avoid damage, wear an antistatic wrist strap and use an antistatic mat when handling components.

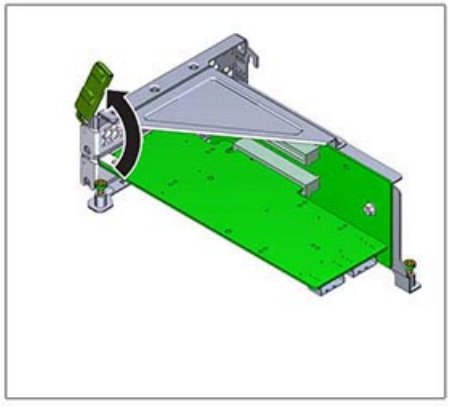
1. Power off the storage controller.
2. Extend the storage controller from the rack.
3. Remove the top cover.
4. Locate the PCIe card position in the storage controller, see ZS3-2 Overview.
5. Disconnect any data cables connected to the cards on the PCIe riser you want to replace. Label the cables for proper connection later.
6. Loosen the two captive screws securing the riser to the motherboard.



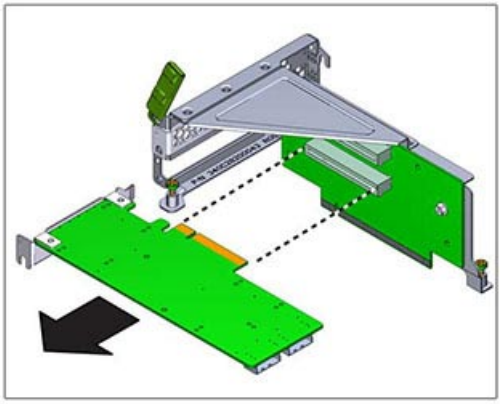
7. Lift the riser straight up and out of its socket on the motherboard.



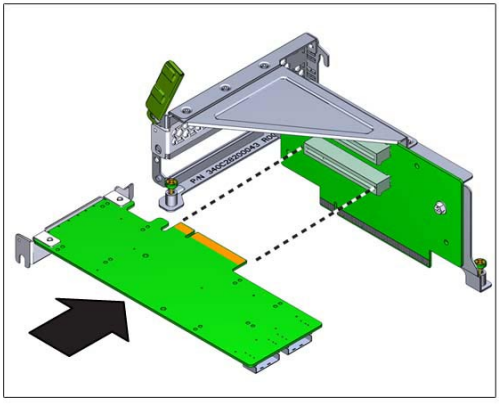
8. Swing the retainer to its fully open (120 degrees) position.



9. Lift the PCIe card off of the bracket alignment pin and out of the socket.

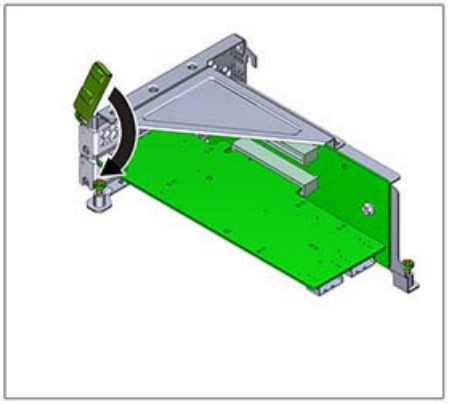


10. Swing the retainer to its fully open (120 degrees) position.
11. Position the PCIe card with where it will install into the riser. The PCIe card bracket mates with the alignment pin and the socket of the riser.

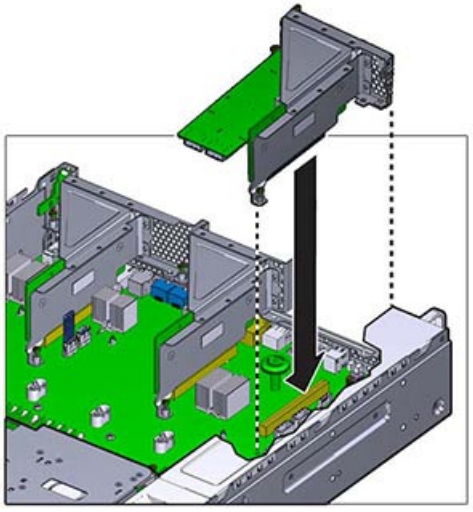


12. Press the PCIe card into the socket.

13. Swing the retainer to its fully closed position. If there is resistance, check the alignment of the PCIe card bracket and try again.



14. Align the riser to the location where it installs into the chassis.
15. Reconnect any previously removed internal cables to any PCIe cards installed in the riser, if doing so will ease installation of the riser.
16. Lower the riser card onto the motherboard and press the card edge connector securely into the socket. The bracket of the riser overlaps the bracket of the adjacent riser.



17. Tighten the two captive screws.
18. Reconnect any previously removed internal or external cables to any PCIe cards installed in the riser.
19. Replace the top cover.
20. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.

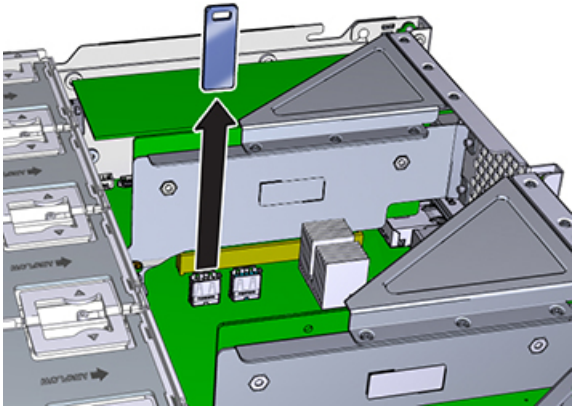
21. Connect the power cords to the power supplies.
22. Verify that standby power is on, indicated by the Power/OK status indicator flashing on the front panel about two minutes after the power cords are plugged in.
23. Use a pen or other pointed object to press and release the recessed Power button on the storage controller front panel. The Power/OK status indicator next to the Power button lights and remains lit.
24. Connect data cables to the PCIe card, routing them through the cable management arm.
25. Go to the Maintenance > Hardware screen of the BUI, and click the details icon on the controller. Then, click Slots to verify the status of the new component. The status indicator should appear green .
26. Install the disk shelf and connect the expansion storage.

USB Flash Drive

Removing the USB flash drive is a cold-service operation. You **must** power off the appliance before you remove the USB. There will be a loss of access to the storage unless the system is in a clustered configuration.

The USB flash drive is located in the forward-most USB socket at the center rear of the motherboard, labeled USB 1, near where Riser 2 installs.

1. Power off the storage controller.
2. Extend the storage controller from the rack.
3. Remove the top cover and air filter.
4. If a PCIe card installed in Riser 2 prevents you from accessing the USB drive, remove Riser 2.
5. Grasp the USB drive and pull it straight up and out of the chassis.



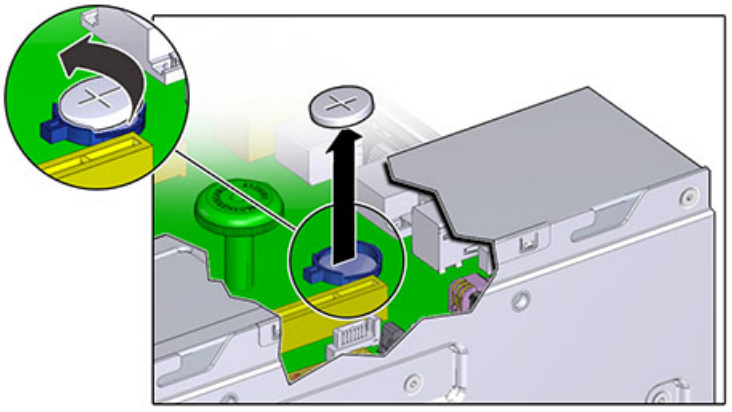
6. Position the replacement USB drive to where it installs onto the motherboard. The USB drive installs into the USB socket that is most forward. The socket is labeled USB 1.
7. Gently insert the USB drive into the USB socket.
8. If you removed Riser 2 to access the USB drive, reinstall Riser 2.
9. Install the top cover.
10. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.
11. Connect the power cords to the power supplies.
12. Use a pen, or other pointed object, to press and release the recessed Power button on the storage controller front panel. The Power/OK status indicator next to the Power button lights and remains lit.

Battery

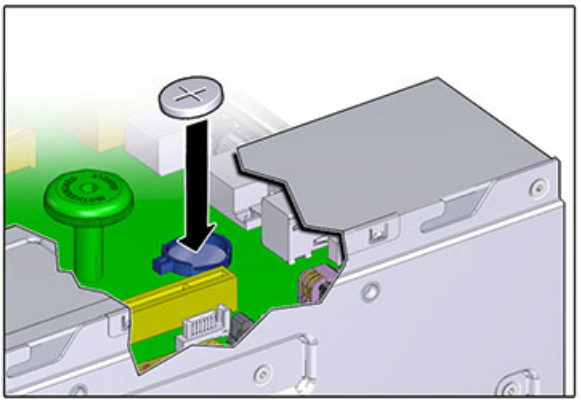
Removing the battery is a cold-service operation. You **must** power off the appliance before you remove the battery. There will be a loss of access to the storage unless the system is in a clustered configuration.

You might need to replace the battery if the storage controller fails to maintain the proper time when powered off and disconnected from the network. You will need a small (No.1 flat-blade) non-metallic screwdriver or equivalent.

1. Power off the storage controller.
2. Extend the storage controller from the rack.
3. Remove the top cover and air filter.
4. Remove Riser 1.
5. Press the tab of the battery receptacle forward to release the battery. The battery pops up.



6. Lift the battery out of the receptacle and set it aside.
7. Position the battery where it will install into the receptacle, with the positive (+) side of the battery facing up.
8. Press the battery into the receptacle until you hear a click.



9. Install Riser 1.
10. Install the top cover.
11. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.
12. Connect the power cords to the power supplies.
13. Use a pen, or other pointed object, to press and release the recessed Power button on the storage controller front panel. The Power/OK status indicator next to the Power button lights and remains lit.
14. Connect data cables to the PCIe card, routing them through the cable management arm.
15. When the system has finished booting, log in and set the time using the steps in the BUI Clock task.

Oracle DE2 and Sun Disk Shelf Interoperability

Oracle DE2s and Sun Disk shelves can be used together with standalone and clustered ZS3-2 controllers after certain hardware modifications. Contact Oracle Service to update your controllers for disk shelf interoperability.

ZS3-4

ZS3-4 CRU Maintenance Procedures

This section provides instructions on how to replace customer replaceable components (CRUs) for Oracle ZFS Storage ZS3-4 controllers.

Refer to Disk Shelf Details for replacing expansion storage shelf components.

Prerequisites

- Read the information in the overview section for your controller to become familiar with the replaceable parts of the system: ZS3-4 Overview
- Follow the instructions in the Safety Information and Required Tools and Information sections.

Safety Information

This section contains safety information that you must follow when servicing the storage system. For your protection, observe the following safety precautions when setting up your equipment:

- Do not remove the side panels, or run the storage system with the side panels removed. Hazardous voltage is present that could cause injury. The covers and panels must be in place for proper air flow to prevent equipment damage.
- Follow all cautions, warnings, and instructions marked on the equipment and described in Important Safety Information for Oracle's Hardware Systems.
- Ensure that the voltage and frequency of your power source match the voltage inscribed on the electrical rating label.
- Follow the electrostatic discharge safety practices. Electrostatic discharge (ESD) sensitive devices, such as PCI cards, HDDs, SSDs, and memory cards, require special handling. Circuit boards and HDDs contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Do not touch the components without using antistatic precautions, especially along the connector edges.

Required Tools and Information

The following tools are needed to service the CRUs:

- Antistatic wrist strap - Wear an antistatic wrist strap and use an antistatic mat when handling components such as HDDs or PCI cards. When servicing or removing storage controller components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Following this practice equalizes the electrical potentials between you and the storage controller.
- Antistatic mat - Place static-sensitive components on an antistatic mat.
- No. 2 Phillips screwdriver
- Nonconducting, No.1 flat-blade screwdriver or equivalent
- Nonconducting stylus or pencil (to power on the storage controller)

Chassis Serial Number

To obtain support for your storage controller or to order new parts, you need your chassis serial number. You can find a chassis serial number label on the storage controller front panel on the left side. Another label is on the top of the storage controller. Alternatively, click the Oracle logo in the BUI masthead to obtain the serial number or issue the following command:

```
hostname: maintenance hardware show
```

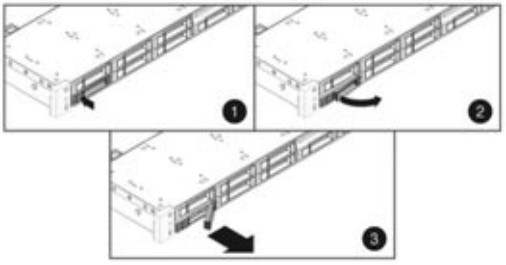
Controller Replacement Tasks

ZS3-4 Controller Replacement Tasks

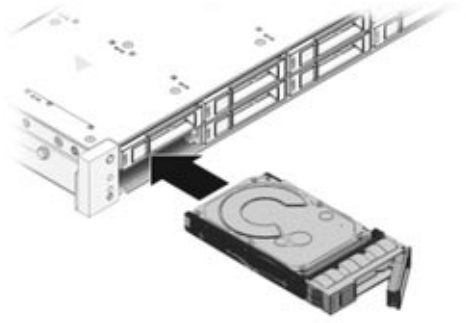
HDD or SSD

1. Identify the failed HDD or SSD by going to the Maintenance > Hardware section of the BUI and clicking the drive details icon . If you are physically at the system, the amber Service Required indicator on the HDD or SSD should be illuminated.
2. If you are not physically at the system, turn on the locator indicator by clicking the locator icon .
3. Push the release button on the HDD or SSD to open the latch.

4. Grasp the latch (2), and pull the drive out of the drive slot.



5. After 15 seconds, navigate to the Hardware > Maintenance screen, and click the details icon on the system controller to verify that the software has detected that the drive is not present.
6. Slide the replacement drive into the slot until it is fully seated.



7. Close the latch to lock the drive in place.

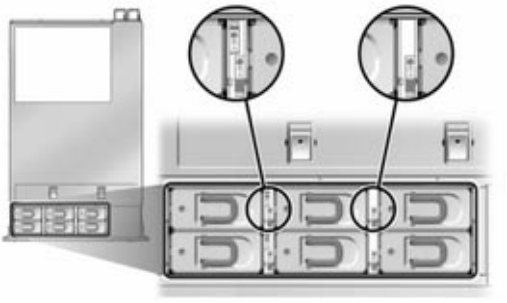
   The Oracle ZFS Storage system software automatically detects and configures the new drive. The device appears in the BUI Maintenance > Hardware screen when you view details for the controller or drive shelf.

Fan Module

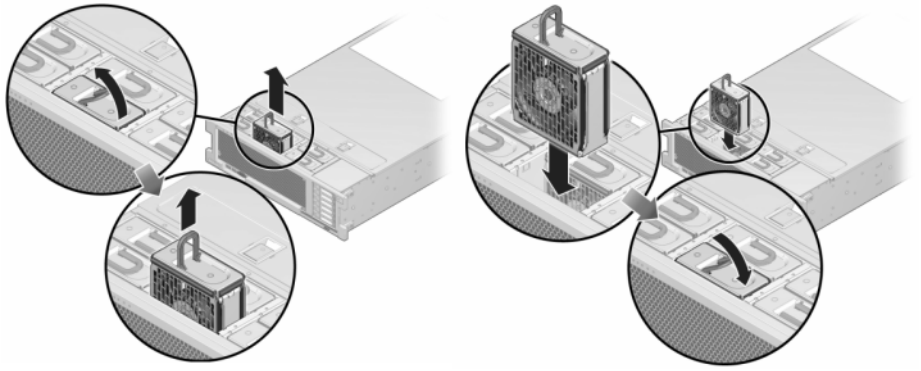
Fan modules are hot-swappable and can be removed and installed while the storage controller is running without affecting other hardware capabilities.

`Caution`: Operating a controller for an extended period of time with fans removed reduces the effectiveness of the cooling system. For this reason, the replacement fan should be unpacked in advance and ready to insert into the controller chassis as soon as the faulted fan is removed.

The following illustration shows the fan modules in the ZS3-4 storage controller.



1. To locate the chassis you want to service, click the associated locate icon on the Maintenance > Hardware screen of the BUI or issue the **`set /SYS/LOCATE status=on`** command at the service processor (SP) prompt. The locate LED will flash on the controller chassis.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.
4. While squeezing the slide release latches, slowly pull the storage controller forward until the slide rails latch.
5. Identify the faulted fan module by locating the corresponding Service Required status indicator or by clicking the locate icon on Maintenance > Hardware screen of the BUI for the fan you want to replace.
6. Lift the latch at the top of the fan module to unlock the fan module, and pull the fan module out.



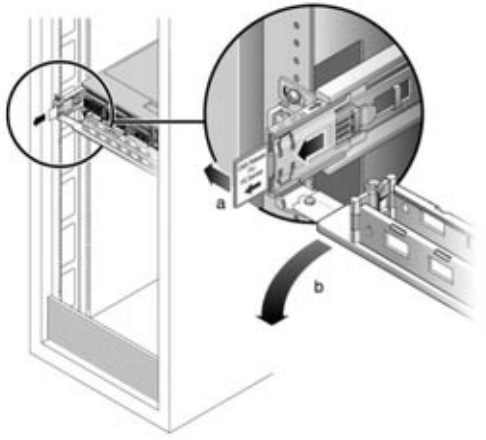
7. Unlock and insert the fan module.
8. Apply firm pressure to fully seat the fan module.

9. Verify that the Fan OK status indicator is lit and that the fault status indicator on the replaced fan module is dim.
10. Verify that the Top Fan status indicator, the Service Required status indicators, and the Locator status indicator/Locator button are dim.
11. Push the release tabs on the side of each rail and slowly slide the storage controller into the rack.

Power Supply

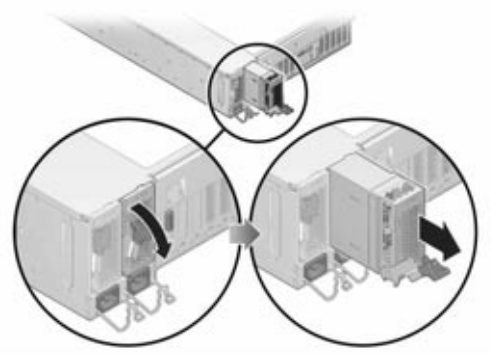
Storage controllers are equipped with redundant hot-swappable power supplies. If a power supply fails and you do not have a replacement, leave the failed power supply installed to ensure proper air flow. A faulted power supply is indicated by an amber colored status LED.

1. Gain access to the rear of the storage controller where the faulted power supply is located.
2. If a cable management arm (CMA) is installed, press and hold the CMA release tab and

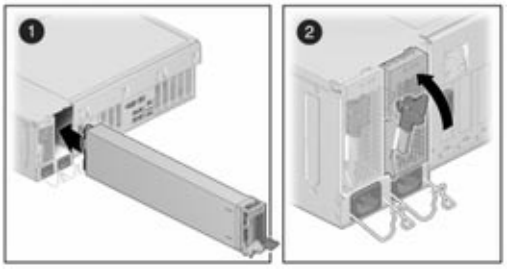


   rotate the arm out of the way.
3. Disconnect the power cord from the faulted power supply.
4. Remove the power supply.

5. Grasp the power supply handle and press the release latch to remove the power supply.



6. Align the replacement power supply with the empty power supply chassis bay.
7. Slide the power supply into the bay until it is fully seated. The following figure shows the power supply.



8. Connect the power cord to the power supply.
9. Verify that the green AC Present status indicator is lit.
10. Close the CMA, inserting the CMA into the rear left rail bracket.
11. Go to the Maintenance > Hardware screen of the BUI. Click details icon for the controller and then click power supply to verify that the status icon is green for the newly installed power supply.

Memory

To identify a specific memory module that has faulted, you must open the storage controller and use the amber status LEDs on the motherboard. To identify a general memory fault, go to the Maintenance > Hardware screen of the BUI, and click on the details icon on the controller. Then click DIMMs to locate the faulted component, indicated by the warning icon .

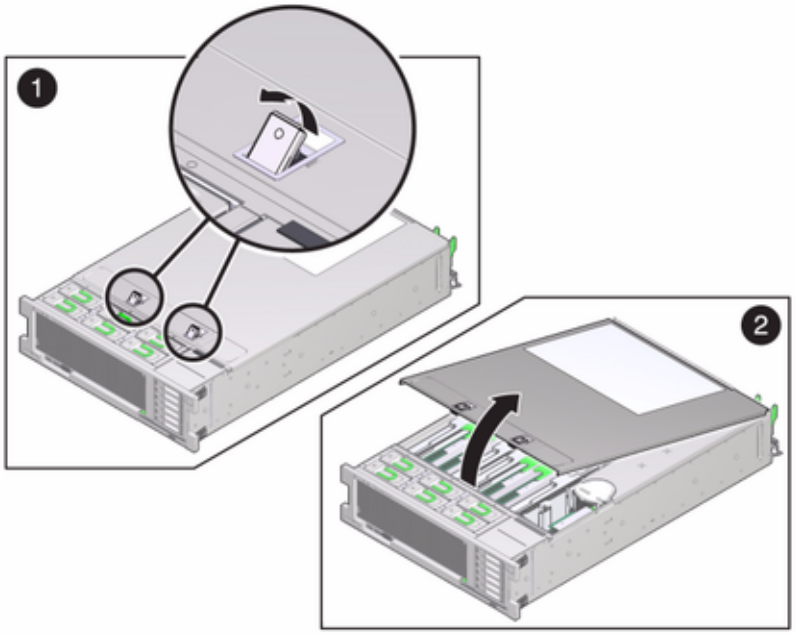
Caution: This procedure requires that you handle components that are sensitive to static discharge, which can cause the component to fail. To avoid damage, wear an antistatic wrist strap and use an antistatic mat when handling components.

You **must** shut down the appliance before beginning this task. Note that there will be a loss of access to the storage unless the system is in a clustered configuration. Shut down the appliance using one of the following methods:

- Log in to the BUI and click the power icon on the left side of the masthead.
- SSH into the appliance and issue the **maintenance system poweroff** command.
- SSH or serial console into the service processor (SP) and issue the **stop /SYS** command.
- Use a pen or nonconducting pointed object to press and release the Power button on the front panel.
- To initiate emergency shutdown during which all applications and files will be closed abruptly without saving, press and hold the power button for at least four seconds until the Power/OK status indicator on the front panel flashes, indicating that the storage controller is in standby power mode.

1. Disconnect the AC power cords from the rear panel of the storage controller.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.
4. While squeezing the slide release latches, slowly pull the storage controller forward until the slide rails latch.
5. To remove the top cover:

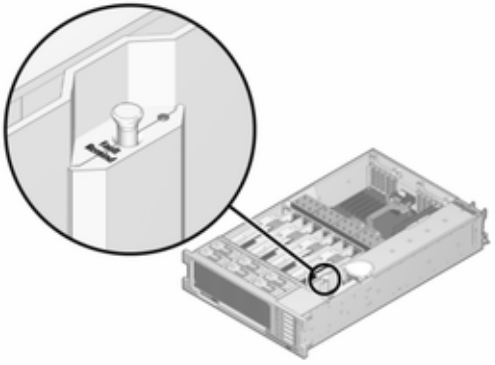
Simultaneously lift both cover latches in an upward motion.



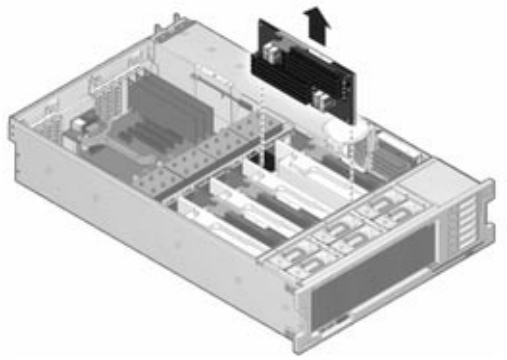
Lift up and remove the top cover.

6. To locate the DIMM you want to service, press the Fault Remind Button on the storage controller.

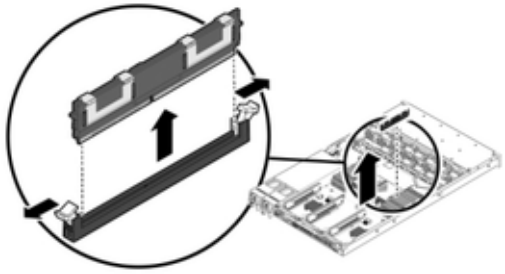
   The following illustration shows the Fault remind button on the ZS3-4.



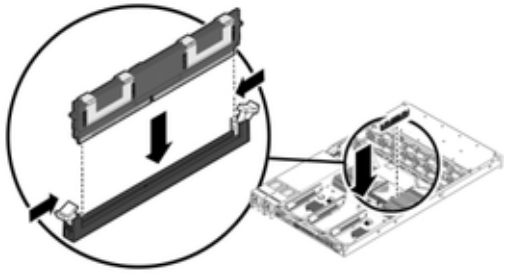
7. Identify the memory riser that hosts the faulted DIMM by the Service Required status indicator. Lift the memory riser straight up to remove it from the motherboard, and place it on an antistatic mat.



8. Rotate both DIMM slot ejectors outward as far as they will go and carefully lift the faulted DIMM straight up to remove it from the socket.

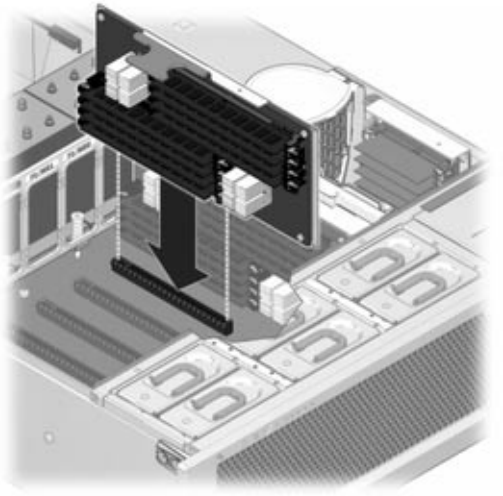


9. Line up the replacement DIMM with the connector, aligning the notch with the key to ensure that the component is oriented correctly.



10. Push the DIMM into the connector until the ejector tabs lock the component in place.
11. To replace the cover:

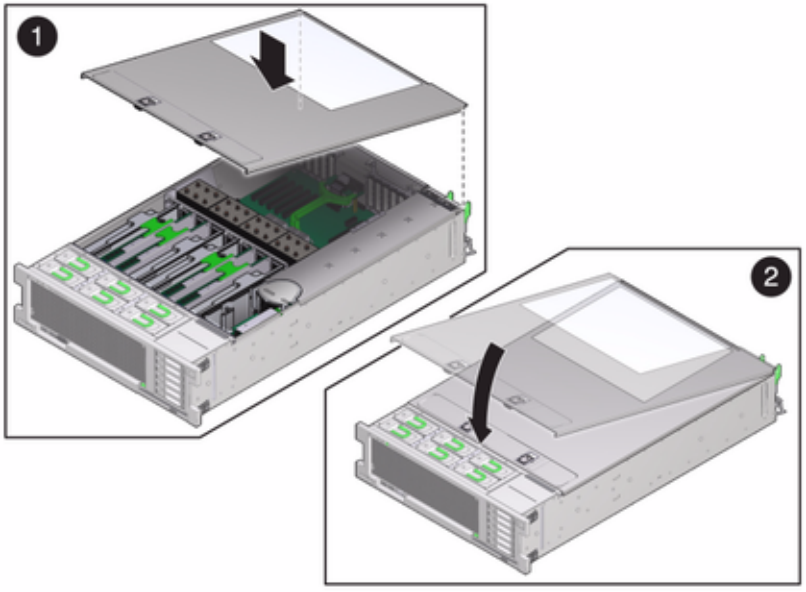
Push the memory riser module into the associated CPU memory riser slot until the riser



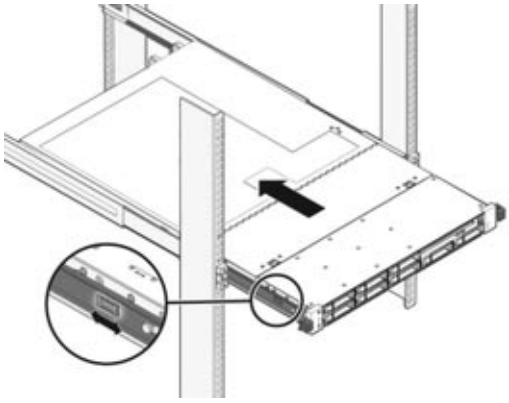
module locks in place.

Place the top cover on the chassis so that it is forward of the rear of the storage controller by about an inch (2.5 cm).

Slide the top cover toward the rear of the chassis until it seats and press down on the cover with both hands until both latches engage.

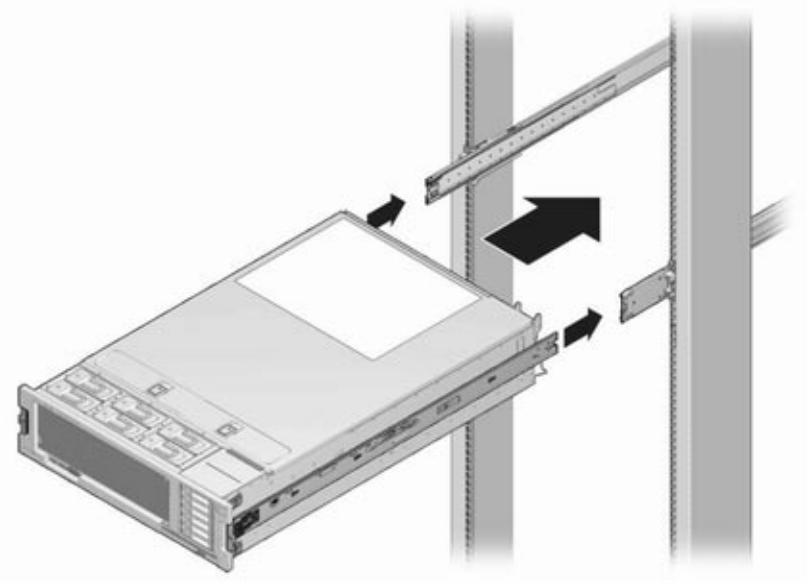


12. Push the release tabs on the side of each rail and slowly push the storage controller into the



rack.

The following image shows the chassis.



13. Connect the power cords to the power supplies.
14. Verify that standby power is on, indicated by the Power/OK status indicator flashing on the front panel about two minutes after the power cords are plugged in.
15. Use a pen or other pointed object to press and release the recessed Power button on the storage controller front panel.

The Power/OK status indicator next to the Power button lights and remains lit. The Maintenance > Hardware screen of the BUI provides status of the replacement on the Details page for DIMMs.

PCIe Cards and Risers

Go to the Maintenance > Hardware screen of the BUI and click the details icon on the controller, and then click Slots to locate the faulted component.

Caution: This procedure requires that you handle components that are sensitive to static discharge, which can cause the component to fail. To avoid damage, wear an antistatic wrist strap and use an antistatic mat when handling components.

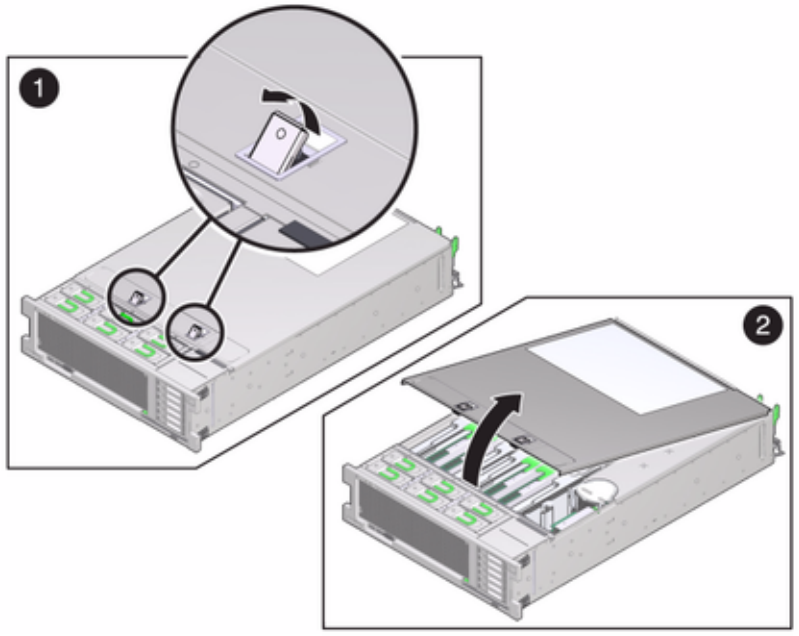
All HBAs must be of the same type. Ensure that you upgrade your system software before installing a newly-released HBA.

You **must** shut down the controller before beginning this task. Note that there will be a loss of access to the storage unless the system is in a clustered configuration. Shut down the appliance using one of the following methods:

- Log in to the BUI, and click the power icon on the left side of the masthead.
- SSH into the storage system and issue the **maintenance system poweroff** command.
- SSH or serial console into the service processor (SP) and issue the **stop /SYS** command.
- Use a pen or non-conducting pointed object to press and release the Power button on the front panel.
- To initiate emergency shutdown, wherein all applications and files will be closed abruptly without saving, press and hold the power button for at least four seconds until the Power/OK status indicator on the front panel flashes, indicating that the storage controller is in standby power mode.

1. Disconnect the AC power cords from the rear panel of the storage controller.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.
4. While squeezing the slide release latches, slowly pull the storage controller forward until the slide rails latch.
5. To remove the top cover:

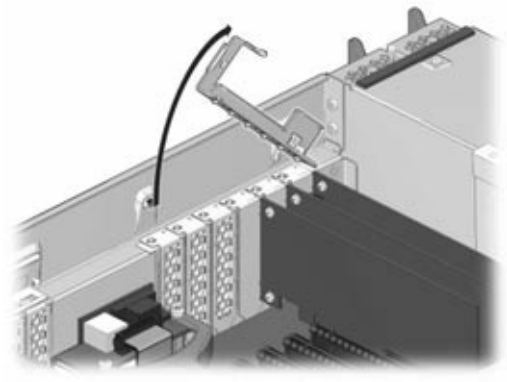
Simultaneously lift both cover latches in an upward motion.



Lift up and remove the top cover.

6. Locate the PCIe card position in the storage controller, see Single and Cluster Controller Configurations.
7. To replace the PCIe card:

   Disengage the PCIe card slot crossbar from its locked position and rotate the crossbar into



   an upright position.

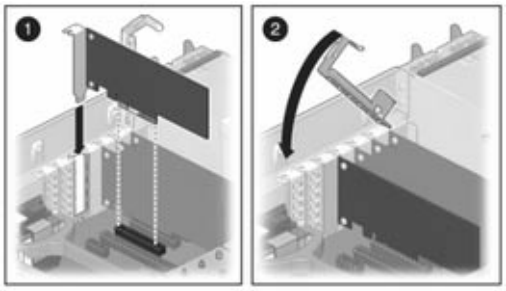
   Remove the retaining screw that holds the PCIe card to the chassis.

Carefully remove the PCIe card from the connector and clean the slot with filtered, compressed air if necessary.

Install the replacement PCIe card into the PCIe card slot.

Install the retaining screw to hold the PCIe card to the chassis.

Return the crossbar to its closed and locked position.

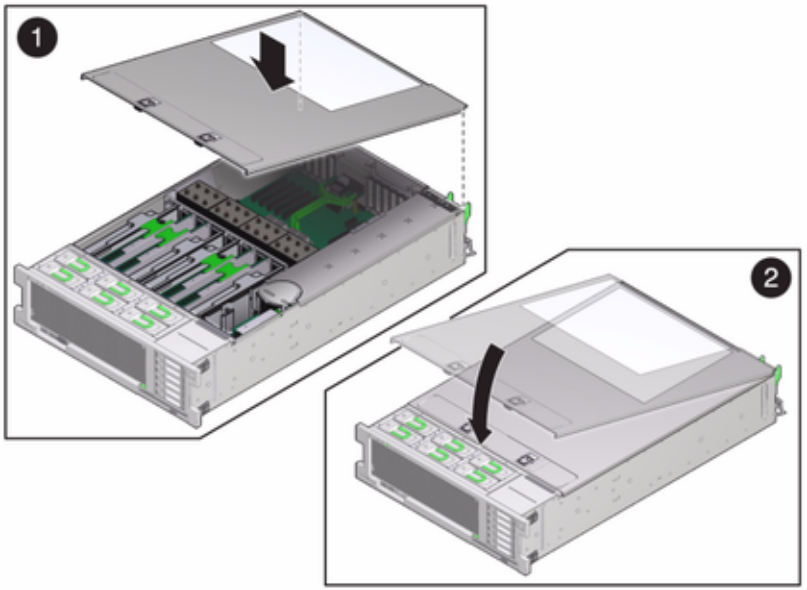


8. To install the top cover:

   Place the top cover on the chassis (1) so that it is forward of the rear of the storage controller by about an inch (2.5 cm).

   Slide the top cover toward the rear of the chassis (2) until it seats.

   Press down on the cover with both hands until both latches engage.



9. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.

10. Connect the power cords to the power supplies.
11. Verify that standby power is on, indicated by the Power/OK status indicator flashing on the front panel about two minutes after the power cords are plugged in.
12. Use a pen or other pointed object to press and release the recessed Power button on the storage controller front panel. The Power/OK status indicator next to the Power button lights and remains lit.
13. Connect data cables to the PCIe card, routing them through the cable management arm.
14. Go to the Maintenance > Hardware screen of the BUI, and click the details icon on the controller. Then, click Slots to verify the status of the new component. The status indicator should appear green .
15. Install the disk shelf and connect the expansion storage.

Battery

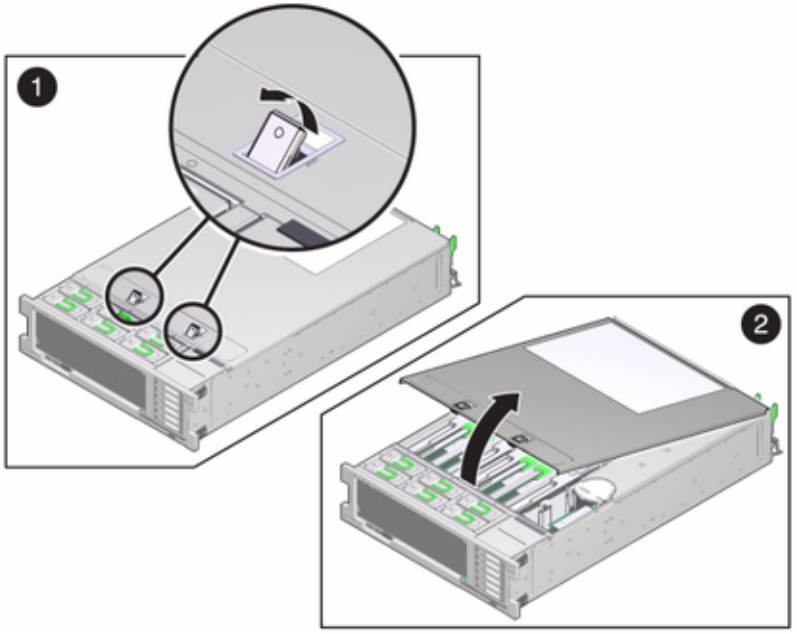
You might need to replace the battery if the storage controller fails to maintain the proper time when powered off and disconnected from the network. You will need a small (No.1 flat-blade) non-metallic screwdriver or equivalent.

You **must** shut down the appliance before beginning this task. Note that there will be a loss of access to the storage unless the system is in a clustered configuration. Shut down the appliance using one of the following methods:

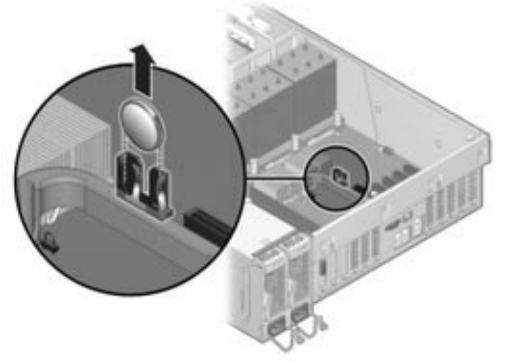
- Login to the BUI and click the power icon on the left side of the masthead.
- SSH into the storage system and issue the **maintenance system poweroff** command.
- SSH or serial console into the service processor and issue the **stop /SYS** command.
- Use a pen or non-conducting pointed object to press and release the Power button on the front panel.
- To initiate emergency shutdown, wherein all applications and files will be closed abruptly without saving, press and hold the power button for at least four seconds until the Power/OK status indicator on the front panel flashes, indicating that the storage controller is in standby power mode.

1. Disconnect the AC power cords from the rear panel of the storage controller.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.
4. While squeezing the slide release latches, slowly pull the storage controller forward until the slide rails latch.
5. To remove the top cover:

Simultaneously lift both cover latches in an upward motion.



6. Lift up and remove the top cover.
7. Using a small, non-metallic screwdriver, press the latch and remove the battery from the



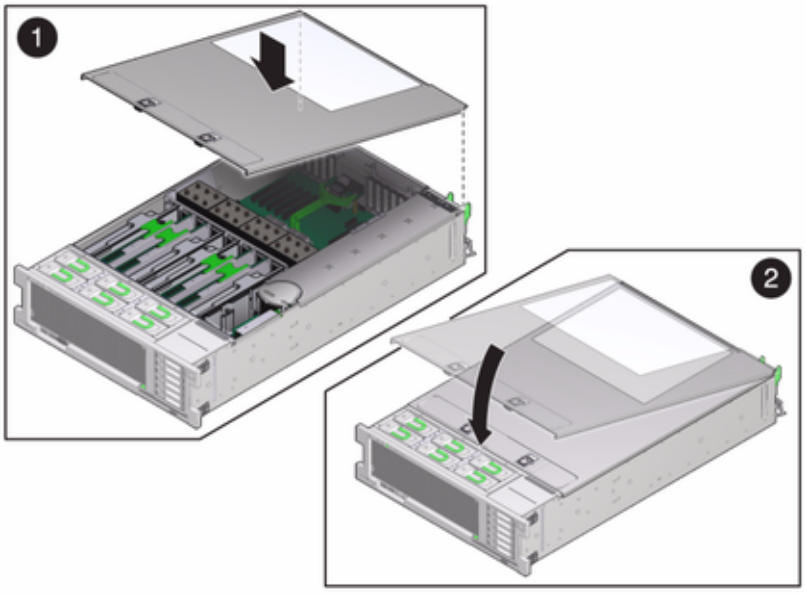
motherboard. The battery is shown here.

8. Press the replacement battery into the motherboard with the positive side (+) facing upward.
9. To install the top cover:

   Place the top cover on the chassis (1) so that it is forward of the rear of the storage controller by about an inch (2.5 cm).

   Slide the top cover toward the rear of the chassis (2) until it seats.

Press down on the cover with both hands until both latches engage.



10. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.
11. Connect the power cords to the power supplies.
12. Verify that standby power is on, indicated by the Power/OK status indicator flashing on the front panel about two minutes after the power cords are plugged in.
13. Use a pen, or other pointed object, to press and release the recessed Power button on the storage controller front panel. The Power/OK status indicator next to the Power button lights and remains lit.
14. Connect data cables to the PCIe card, routing them through the cable management arm.
15. When the system has finished booting, log in and set the time using the steps in the BUI Clock task.

Oracle DE2 and Sun Disk Shelf Interoperability

Oracle DE2s and Sun Disk Shelves can be used together with standalone and clustered 7x20 controllers after certain hardware modifications. Contact Oracle Service to update your controllers for disk shelf interoperability.

7120

7120 Hardware Overview

Use the information in this section as a reference when preparing to service replaceable components of the Sun ZFS Storage 7120.

Refer to the following for procedural instructions:

- Controller Tasks - replace system controller components
- Disk Shelf Tasks - replace disk shelf components

Chassis Overview

The Sun ZFS Storage 7120 is an enterprise-class two-socket rackmount x64 system powered by the Intel Xeon processor. It packs high performance and room for growth with four PCIe slots and 18 DIMM slots into a compact 2U footprint. Refer to http://www.oracle.com/us/products/servers-storage/storage/nas/overview/index.html (`http://www.oracle.com/us/products/servers-storage/storage/nas/overview/index.html`) for the most recent component specification.

Refer to the *Implementing Fibre Channel SAN Boot with Oracle's Sun ZFS Storage Appliance* whitepaper at http://www.oracle.com/technetwork/articles/servers-storage-admin/fbsanboot-365291.html (`http://www.oracle.com/technetwork/articles/servers-storage-admin/fbsanboot-365291.html`) for details on FC SAN boot solutions using the Sun ZFS Storage 7120.

The 7120 is a standalone controller that consists of an internal SAS-2 HBA providing disk shelf expansion, write flash acceleration, and 11 x 300GB 15K, 600GB 15K, 1TB 7.2K, 2TB 7.2K, or 3TB 7.2K hard drive storage. The SAS-2 storage fabric supports a greater number of targets, greater bandwidth, higher reliability, and bigger scale.

The 2U chassis form factor dimensions are as follows:

Dimension	Measurement	Dimension	Measurement
Height	87.6 mm/3.45 in	Depth	765.25 mm/30.13 in
Width	436.8 mm/17.2 in	Weight	29.54 kg/65 lb

Front Panel

The following figure and legend show the front panel and the drive locations. The Logzilla 3.5" SSD belongs in slot 3 and is not supported in controllers configured with the internal Sun Aura flash HBA Logzilla.

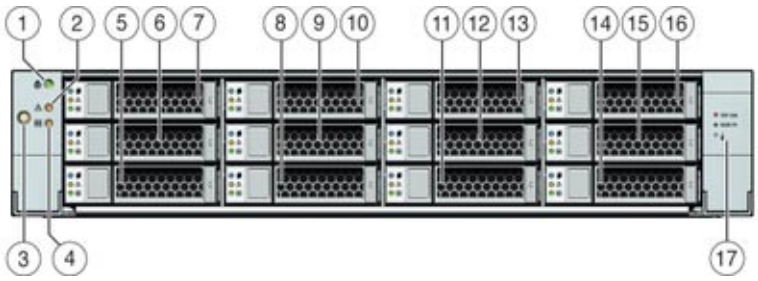


Figure Legend		
1 Locator LED/button (white)	**7** HDD 2	**13** HDD 8
2 Service Action Required LED (amber)	**8** HDD or SSD 3	**14** HDD 9
3 Power button	**9** HDD 4	**15** HDD 10
4 Power/OK LED (green)	**10** HDD 5	**16** HDD 11
5 HDD 0	**11** HDD 6	**17** Drive map
6 HDD 1	**12** HDD 7	

Rear Panel

The following figure and legend show the rear panel.

Note: Optional Sun Dual Port 40Gb/sec 4x Infiniband QDR HCAdapter PCIe cards (375-3606-01) may be located in slots 1, 2, or 3. 375-3606-01 HCA expansion cards are not supported in the 10Gb network configurations.

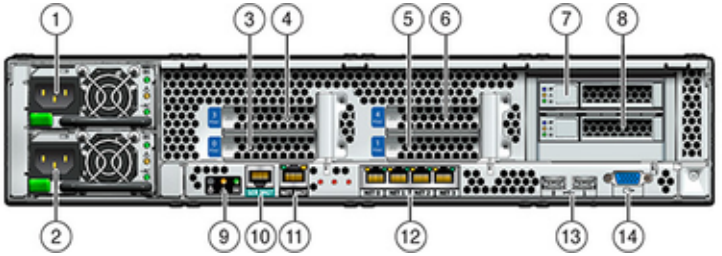


Figure Legend		
1 Power Supply Unit 1	**6** PCIe 4	**11** Network Management port
2 Power Supply Unit 0	**7** Boot HDD 1	**12** Gbit Ethernet ports NET 0, 1, 2, 3
3 PCIe 0	**8** Boot HDD 0	**13** USB 2.0 ports (0, 1)

Figure Legend		
4 PCIe 3	**9** Rear Panel System Status LEDs	**14** HD15 Video port
5 PCIe 1	**10** Serial Management port	

The serial management connector (SER MGT) is an RJ-45 port and provides a terminal connection to the SP console.

The network management connector (NET MGT) is an RJ-45 port and provides an alternate terminal interface to the SP console.

There are four RJ-45 Gigabit Ethernet ports (NET0, NET1, NET2, NET3) located on the motherboard that operate at 10/100/1000 Mbit/sec. These network interfaces must be configured before use.

Electrical Specifications

The following list shows the electrical specifications for the 7120. Note that the power dissipation numbers listed are the **maximum** rated power numbers for the power supply. The numbers are not a rating of the actual power consumption of the appliance.

Connectors

- Two C13 connectors which work on 110-220v outlets

Input

- Nominal frequencies: 50/60Hz
- Nominal voltage range: 100-120/200-240 VAC
- Maximum current AC RMS: 13.8A @ 100 VAC
- AC operating range: 90-264 VAC

Output

- 3.3 VDC STBY: 3.0A

- +12 VDC: 86.7A

Power dissipation

- Max power consumption: 1235.3 W
- Max heat output: 4212 BTU/hr
- Volt-Ampere rating: 1261 VA @ 240 VAC, 0.98P.F.

Internal Components

The chassis has the following boards installed.

Note: Field-replaceable units (FRU) should only be replaced by trained Oracle service technicians.

- **PCIe Risers** - Each riser supports two PCIe cards that are customer-replaceable. There are two risers per system, each attached to the rear of the motherboard.
- **Motherboard** - The motherboard is a FRU and includes CPU modules, slots for 18 DIMMs, memory control subsystems, and the service processor (SP) subsystem. The SP subsystem controls the host power and monitors host system events (power and environmental). The SP controller draws power from the host 3.3V standby supply rail, which is available whenever the system is receiving AC input power, even when the system is turned off.
- **Power Distribution Board** - The power distribution board is a FRU and distributes main 12V power from the power supplies to the rest of the storage controller. It is directly connected to the connector break out board and to the motherboard through a bus bar and ribbon cable. It also supports a top cover interlock *kill* switch. The power supplies connect directly to the power distribution board.
- **Connector Break Out Board** - The connector break out board is FRU and serves as the interconnect between the power distribution board and the fan power boards, storage drive backplane, and I/O board. It also contains the top-cover interlock "kill" switch.
- **Fan Power Boards** - The two fan power boards are FRUs and carry power to the system fan modules. In addition, they contain fan module status LEDs and transfer I2C data for the fan modules.
- **Storage Drive Backplane** - The storage drive backplane is a FRU and includes the connectors for the storage drives, as well as the interconnect for the I/O board, power and locator buttons, and system/component status LEDs. The system has a 12-disk backplane. Each drive has an LED indicator for Power/Activity, Fault, and Locate.

I/O Components

The following figure and legend show the I/O components of the 7120 system.

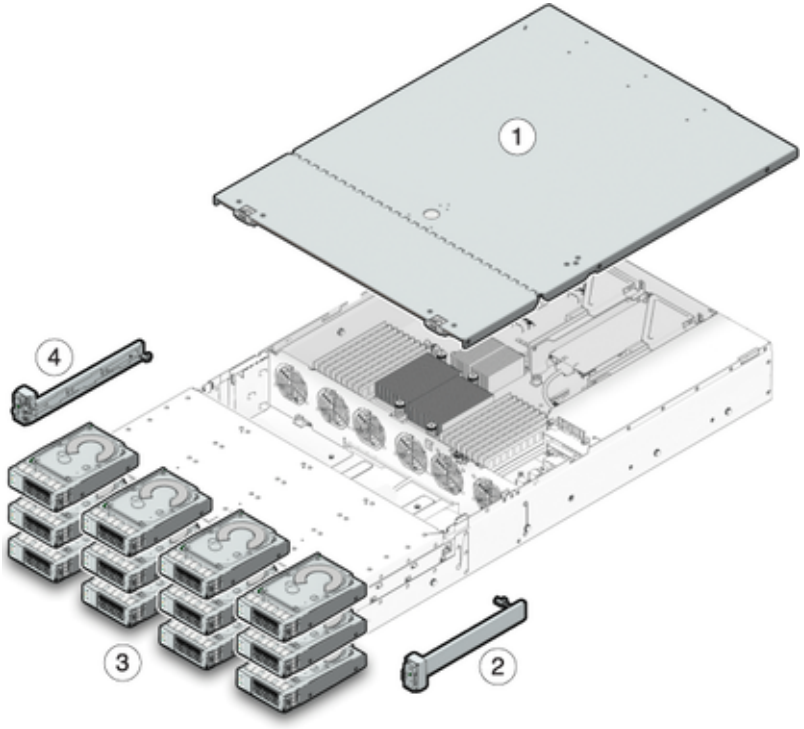
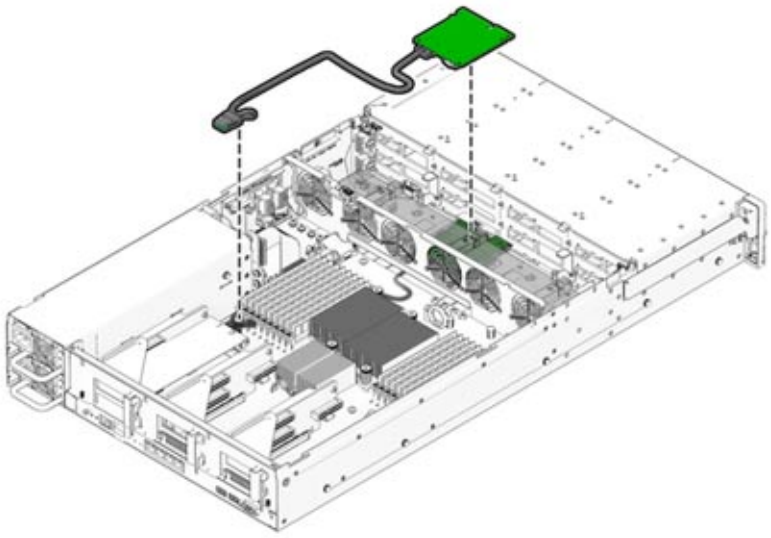


Figure Legend	
1 Top Cover	**3** Hard Disk Drives
2 Right Control Panel Light Pipe Assembly	**4** Left Control Panel Light Pipe Assembly

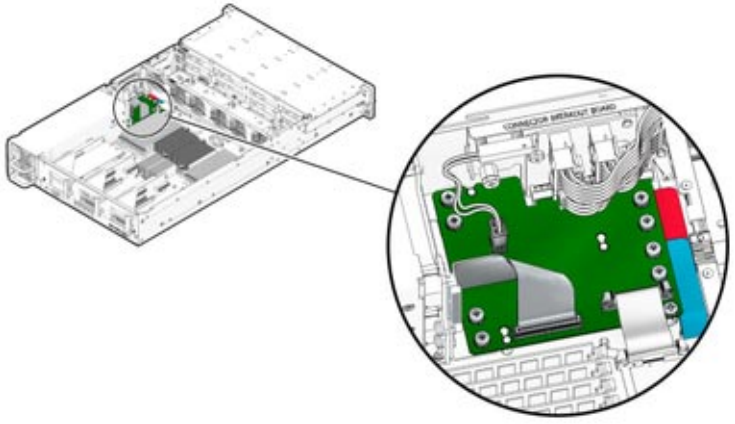
Cables

The following figure and legend show the storage controller internal cables.

Note: The rear boot drives are not depicted in this illustration.



Cable	Connection
1 Storage Drive Data Cable	Connection between the HBA PCI-Express Card and the storage drive backplane.



Cable	Connection
2 Ribbon cable	Connection is between the power distribution board and the motherboard.

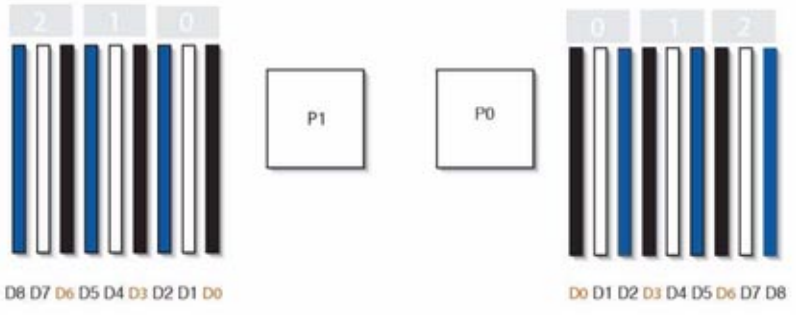
CPU and Memory

The 7120 motherboard has 18 slots in two groups that hold industry-standard DDR3 DIMMs. The standard memory configuration is 48GB, 6x8GB DDR-1333 low voltage (LV) DIMMS.

Following are the replaceable CPU and memory components of the 7120 system.

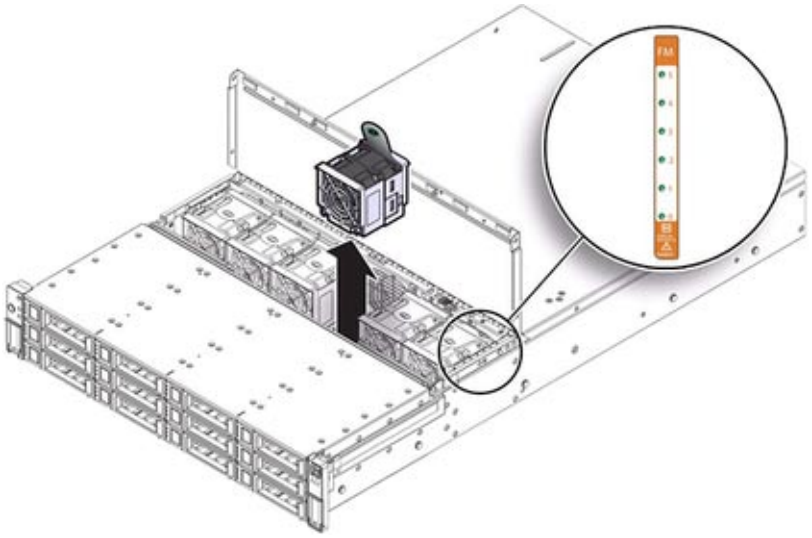
Part Number	Description	FRU/CRU
F371-4966-01	DIMM, 8GB, DDR3, 2RX4, 13	CRU
F371-4885-01	Intel E5620, 2.40G	FRU

All sockets must be occupied by either a filler or a DDR3 DIMM. All DDR3 DIMMs must be identical. DIMMs are pre-installed in P0 slots D1, D2, D4, D5, D7, and D8.



Power Distribution, Fan Module and Disk Components

The fan modules and LEDs are shown in the following illustration.



The following figure and legend show the power distribution and associated components.

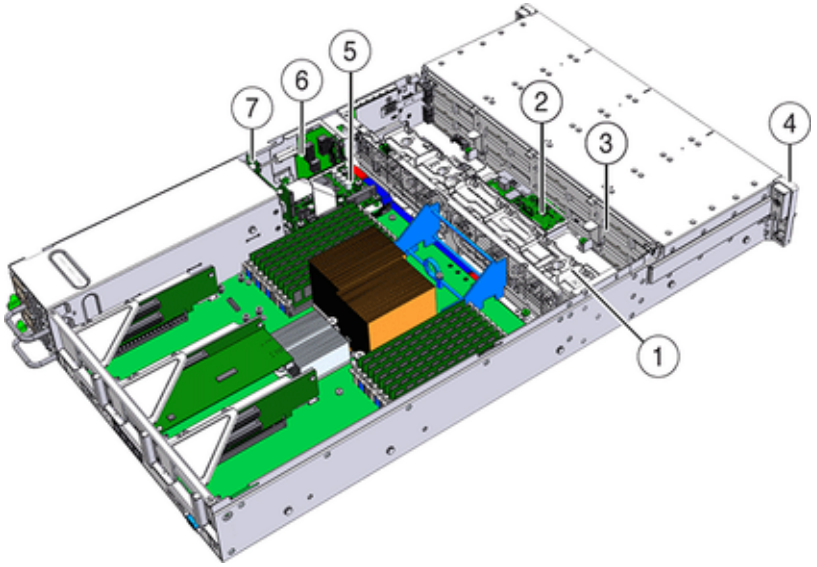


Figure Legend	
1 Fan Board	**5** Power Distribution Board

Figure Legend	
2 SAS Expander Board	**6** Connector Board
3 Disk Backplane	**7** Power Supply Backplane
4 Front Control Panel Light Pipe Assembly	

Standalone Controller Configurations

The following table shows the configuration options for a 7120 controller. All PCIe cards are low-profile, and must be fitted with low-profile mounting brackets.

This table describes base configurations for the 7120 with Aura Logzilla.

Mktg Part Number	Description	Mfg Part Number
TA7120-12TB	S7120, 1xCPU, 24GB, 12TB	597-0754-01
TA7120-24TB	S7120, 1xCPU, 24GB, 24TB	597-0755-01

The following table describes base configurations for the 7120 with Logzilla 3.5" SSD.

Mktg Part Number	Description	Mfg Part Number
7101282	S7120, 1xCPU, 24GB, 3.3TB	7014523
7101284	S7120, 1xCPU, 24GB, 6.6TB	7014525

NIC/HBA Options

The following table describes NIC/HBA options for the 7120.

Mktg Part Number	Description	Mfg Part Number
SG-XPCIESAS-GEN2-Z	2-port External Sun Thebe SAS (x4) HBA, PCIe	594-5889-01
SG-XPCIE2FC-QF8-Z	2-port FC HBA, 8Gb, PCIe	594-5684-01
X4446A-Z	4-port PCI-E Quad GigE UTP	594-4024-01
X4237A-N	2-port 4X IB HCA PCIe	594-5862-02
X1109A-Z	2-port 10Gig SFP+ NIC, PCIe	594-6039-01

PCIe Options

The following table describes the supported PCIe configuration option summary for the 7120.

Slot	Type	Sun Part Number	Vendor Part Number	Description	Note
0	PCIe	540-7975-03	Sun Aura	Internal Flash HBA Logzilla	Base Configuration (OBSOLETE)
0	PCIe	375-3481-01	Intel EXPI9404PT	QP Copper NIC	Optional Recommended Front-end
0	PCIe	375-3617-01	Intel Niantic	DP Optical 10GE NIC	Optional Recommended Front-end
0	PCIe	371-4325-01	QLogic	8Gb DP FC HBA	Optional FC Target or Initiator (Bac
0	PCIe	375-3606-01	Mellanox MHJH29-XTC	InfiniBand HCA	Optional Recommended Front-end
1	PCIe	375-3617-01	Intel Niantic	DP Optical 10GE NIC	Optional Recommended Front-end
1	PCIe	375-3606-01	Mellanox MHJH29-XTC	InfiniBand HCA	Optional Recommended Front-end
1	PCIe	375-3481-01	Intel EXPI9404PT	QP Copper NIC	Optional Recommended Front-end
1	PCIe	371-4325-01	QLogic	8Gb DP FC HBA	Optional FC Target or Initiator (Bac
3	PCIe	375-3665-01	Sun Thebe (INT)	Internal SAS HBA	Base Configuration
4	PCIe	375-3481-01	Intel EXPI9404PT	QP Copper NIC	Optional Recommended Front-end
4	PCIe	371-4325-01	QLogic	8Gb DP FC HBA	Optional FC Target or Initiator (Bac
4	PCIe	375-3609-03	Sun Thebe (EXT)	8P 6Gb/s SAS HBA	Additional Optional Back-end

Attached Storage

The 7120 standalone configurations allow a single chain of 1 or 2 disk shelves. Write-optimized (Logzilla) SSDs are not supported in the expansion storage for the 7120. The disk shelves must be fully populated with 24 HDDs. Half-populated shelf configurations are not supported.

7320

7320 Hardware Overview

Use the information in this section to prepare to service replaceable components of the 7320 system. After you have reviewed this section, refer to these procedural instructions:

- Controller Tasks - replace storage controller components
- Disk Shelf Tasks - replace disk shelf components

Chassis Overview

The Sun ZFS Storage 7320 consists of either a single storage controller or two storage controllers in a high availability cluster configuration. Both the single and clustered configuration supports one to six disk shelves.

The 7320 controller base configuration includes two CPUs, built-in 4 x 1Gb/s front-end GigE ports, redundant power supplies, NIC options for expanded front-end support, tape backup, InfiniBand, and dual port SAS HBA for storage expansion.

The CPUs are Intel Xeon 5600 series, 2.40GHz, 80W, with 4 core processors. The standard memory configuration is 96GB, 6 x 8GB DDR3-1333 low voltage (LV) DIMMs per CPU. Memory can be upgraded to 144GB using 9 x 8GB DDR3-1333 LV DIMMs per CPU (for a total of 18 x 8GB for two CPUs). Earlier versions of the 7320 controller included 24GB (base), 48GB, or 72GB memory options. The clustered configuration simply uses two servers and a cluster card in each server for a heartbeat connection between the servers.

All user-accessible storage is provided by one to six disk shelves that are external to the server(s). RAID functions are managed by software. Solid state 18GB SAS-1 drives (7320 SAS-2) are used for a high-performance write cache (known as LogZilla) or ZFS intent log (ZIL) devices, and are used in place of up to four of the 24 drives in a disk shelf. The remaining 20 drives are available for storage.

Refer to the http://www.oracle.com/us/products/servers-storage/storage/unified-storage/index.html (`http://www.oracle.com/us/products/servers-storage/storage/unified-storage/index.html`) for the most recent component specification.

The 7320 is a SAS-2 (Serial Attached SCSI 2.0) device that consists of an HBA, disk shelf, and disks (1TB and 2TB SAS-2). The SAS-2 storage fabric supports a greater number of targets, greater bandwidth, higher reliability, and bigger scale than the SAS-1 fabric.

Boards

The 7320 storage controller chassis has the following boards installed.

`Note:` Field-replaceable units (FRUs) should only be replaced by trained Oracle service technicians.

- **`PCIe Risers`** - The storage controller contains three PCIe risers that are customer-replaceable units (CRUs) and are attached to the rear of the motherboard. Each riser supports one PCIe card.
- **`Motherboard`** - The motherboard is a FRU and includes CPU modules, slots for 18 DIMMs, memory control subsystems, and the service processor (SP) subsystem. The SP subsystem controls the host power and monitors host system events (power and environmental). The SP controller draws power from the host 3.3V standby supply rail, which is available whenever the system is receiving AC input power, even when the appliance is turned off.

- **Power Distribution Board** - The power distribution board is a FRU and distributes main 12V power from the power supplies to the rest of the storage controller. It is directly connected to the paddle board and to the motherboard through a bus bar and ribbon cable. It also supports a top cover interlock *kill* switch.
- **Paddle Board** - The paddle board is a FRU and serves as the interconnect between the power distribution board and the fan power boards, hard drive backplane, and I/O board.
- **Fan Board** - The fan boards are FRUs and carry power to the storage controller fan modules. In addition, they contain fan module status LEDs and transfer I2C data for the fan modules.
- **Disk Backplane** - The hard drive backplane is a FRU and includes the connectors for the hard disk drives, as well as the interconnect for the I/O board, Power and Locator buttons, and system/component status LEDs. The storage controller has an eight-disk backplane. Each drive has an LED indicator for Power/Activity, Fault, and OK-to-Remove (not supported).

The following list contains the replaceable system boards for the 7320 storage controller.

Part Number	Description	FRU/CRU
F541-2883-01	X8 PCIe Riser Card 1U	CRU
F541-2885-01	X16 PCIe Riser Card 1U	CRU
F541-4081-01	RoHS Motherboard and Tray	FRU
F511-1489-01	DB, Power Distribution Board	FRU
F511-1548-01	PCB, 8 Disk 1U Backplane	FRU
F541-4275-02	PCBA, Connector Board, 1U	FRU

Cables

The following list contains the replaceable cables for the 7320 storage controller.

Part Number	Description	FRU/CRU
F530-4228-01	Cable, Mini SAS	FRU (internal)
F530-3927-01	FRU,CBL,PDB,MB,1U+2U,RIBBON	FRU (internal)
F530-4431-01	Cable, Fan data	FRU (internal)
F530-4417-01	FRU Cable, Fan paddle	FRU (internal)
F530-3880-01	Cable, Assembly, Ethernet, Shielded, RJ45-RJ45, 6m	CRU (external)
F530-3883-01	FRU,2M,4X Mini SAS Cable	CRU (external)

7320 I/O Components

The following figure and legend identify the I/O components of the storage controller.

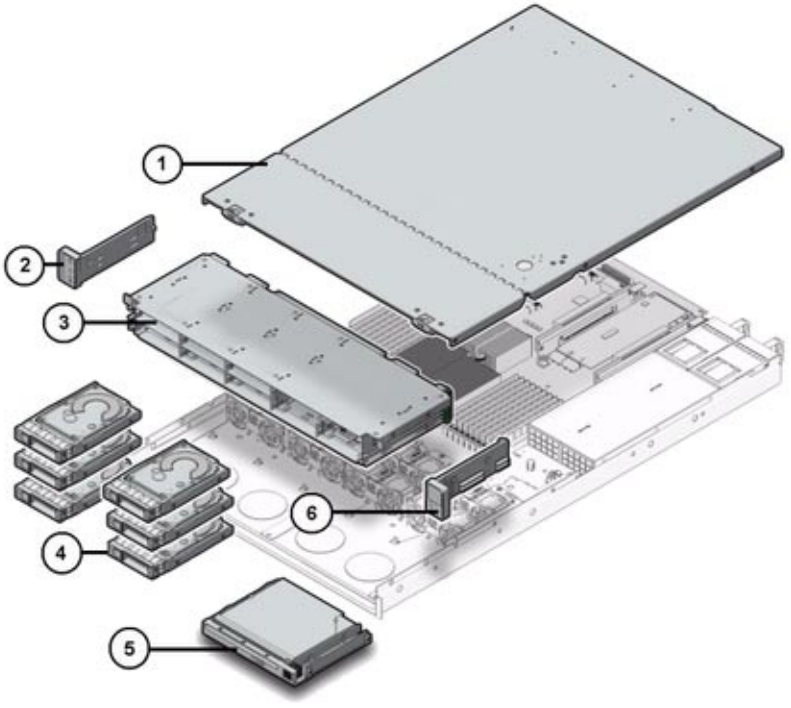


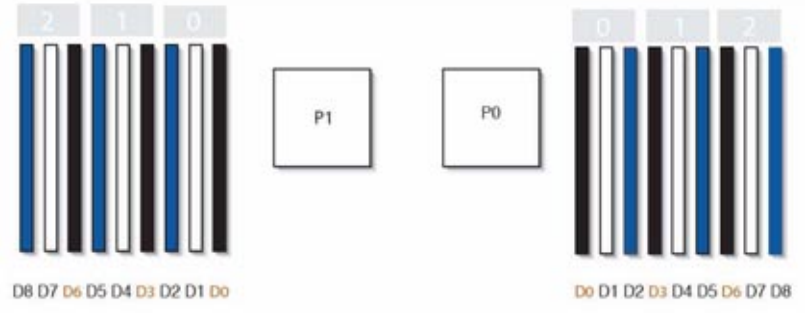
Figure Legend	
1 Top cover	**2** Left Control Panel Light Pipe Assembly
3 Drive Cage	**4** Solid State Drives
5 blank/USB Module	**6** Right Control Panel Light Pipe Assembly

7320 CPU and Memory Components

The following list contains the replaceable CPU and memory components of the 7320.

Part Number	Description	FRU/CRU
F371-4966-01	DIMM, 8GB, DDR3, 2RX4, 13	CRU
F371-4885-01	Intel E5620, 2.40G	FRU

The storage controller motherboard has 18 slots in two groups that hold industry-standard DDR3 DIMM memory cards. All sockets must be occupied by either a filler or a DDR3 DIMM.



7320 Power Distribution and Fan Module Components

The following figure and legend identify the Power Distribution/Fan Module components of the storage controller.

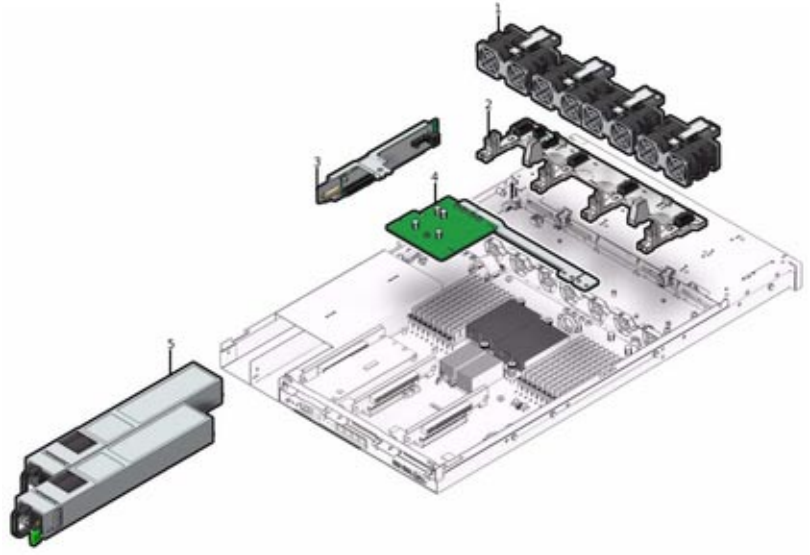


Figure Legend	
1 Fan Modules	**4** Power Distribution/Bus Bar Assembly
2 Fan Board	**5** Power Supplies

Figure Legend
3 Paddle Board

Electrical Specifications

The following list shows the electrical specifications for the 7320.

Note: The power dissipation numbers listed are the maximum rated power numbers for the power supply. The numbers are not a rating of the actual power consumption of the appliance.

Connectors

- Two C13 connectors which work on 110-220v outlets

Input

- Nominal frequencies: 50/60Hz
- Nominal voltage range: 100-120/200-240 VAC
- Maximum current AC RMS: 9.0 amps Max
- AC operating range: 90-264 VAC

Output

- 3.3 VDC STBY: 3.6A
- +12 VDC: 62.3A

Power dissipation

- Max power consumption: 873 W
- Max heat output: 2977 BTU/hr
- Volt-Ampere rating: 891 VA @ 240 VAC, 0.98P.F.

7320 Front Panel

The following figure and legend identify the front panel LEDs.

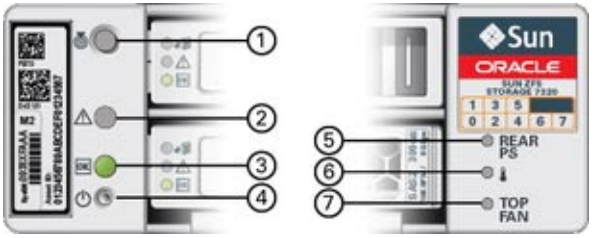


Figure Legend
1 Locate Button/LED
2 Service Required LED (amber)
3 Power/OK LED (green)
4 Power Button
5 Rear Power Supply
6 System Overtemperature LED
7 Top Fan

The following figure and legend identify the 7320 front panel drive locations. Two mirrored hard disk drives (HDDs) that store the operating system reside in slots 0 and 1. Up to four solid state drives (ReadZilla SSDs), which store the read cache, fill slots 2 through 5, in order. Slots 6 and 7 are empty and must contain drive fillers.

Disk Drive Locations				
HDD1	HDD3	HDD5		
HDD0	HDD2	HDD4	HDD6	HDD7

7320 Replaceable Components

The following list contains all of the replaceable power distribution, disk, and fan module components of the 7320. Note that power supplies, disks, and fan modules are hot-pluggable on the storage controller.

Part Number	Description	FRU/CRU
F300-2233-02	RoHS 760W Power Supply	CRU
F541-2075-04	Buss Bar Power, 1U	FRU
F542-0184-01	DR, 3Gb SATA	CRU
F542-0330-01	2.5" 512GB ReadZilla SSD	CRU

Part Number	Description	FRU/CRU
F541-276-01	ASSY,FAN Module	CRU
F541-4274-02	Fan Board (1U)	FRU

7320 PCIe Cards and Risers

Following is the complete list of replaceable PCIe cards for the 7320 system.

Part Number	Description	FRU/CRU
F371-4325-01	8Gb FC HBA (PCIe)	CRU
F375-3609-02	PCA, SAS 6GBS 8 Port (PCIe)	CRU
F375-3606-03	Dual Port (x4) IB HCA (PCIe)	CRU
F375-3696-01	Dual Port CX2 4XQDR (PCIe)	CRU
F375-3617-01	2X10GbE SFP+, X8 (PCIe)	CRU
F375-3481-01	NIC Card Quad Port 1GigE Cu (PCIe)	CRU
F511-1496-04	Sun Fishworks Cluster Controller 200 (PCIe)	FRU

7320 Rear Panel

Following is an illustration of the 7320 storage controller rear panel. The Sun 375-3609 belongs in slot 2, cannot be installed in any other slots, and a second is not offered as an option.

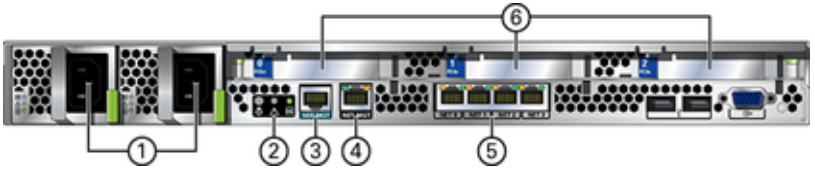


Figure Legend	
1 Power supplies	**4** Network management port
2 SC summary status LEDs	**5** Ethernet ports
3 Serial management port	**6** PCIe slots

7320 Single and Cluster Controller Configurations

The single controller base configuration is 96GB RAM, 2x2.4GHz Quad-Core processors, one external SAS HBA, and four 10/100/1000 Ethernet ports.

The following table describes base configurations for the 7320.

Mktg Part Number	Description	Mfg Part Number
TA7320-24A	S7320, 2xCPU, 24GB, Single	597-1060-01
7104054	S7320, 2xCPU, 96GB, Single	7045900
TA7320-24A-HA	S7320, 2xCPU, 24GB, Cluster	597-1061-01
7104055	S7320, 2xCPU, 96GB, Cluster	7045903

Following are the PCIe configuration options for a single controller. All PCIe cards are low profile and must be fitted with low-profile mounting brackets.

Slot	Type	Part Number	Vendor Part	Description	Note
0	PCIe	375-3617-01	Intel Niantic	DP Optical 10GE NIC	Optional Recommended Front-end
0	PCIe	375-3696-01	Mellanox	InfiniBand HCA	Optional Recommended Front-end
0	PCIe	375-3606-03	MHJH29-XTC	InfiniBand HCA	Optional Recommended Front-end
0	PCIe	375-3481-01	Intel EXPI9404PT	QP Copper NIC	Optional Recommended Front-end
0	PCIe	371-4325-01	QLogic	8Gb DP FC HBA	Optional FC Target or Initiator (Backup)
1	PCIe	375-3617-01	Intel Niantic	DP Optical 10GE NIC	Optional Recommended Front-end
1	PCIe	375-3696-01	Mellanox	InfiniBand HCA	Optional Recommended Front-end
1	PCIe	375-3606-03	MHJH29-XTC	InfiniBand HCA	Optional Recommended Front-end
1	PCIe	375-3481-01	Intel EXPI9404PT	QP Copper NIC	Optional Recommended Front-end
1	PCIe	371-4325-01	QLogic	8Gb DP FC HBA	Optional FC Target or Initiator (Backup)
2	PCIe	375-3609-03	Sun Thebe	External SAS HBA	Base Configuration

7320 Cluster Configurations

The 7320 cluster base configuration is 96GB RAM, 2x2.4GHz Quad-Core processors, one external SAS HBA, and four 10/100/1000 Ethernet ports, and a Cluster card. The Sun Storage 7420C Cluster Upgrade Kit (XOPT 594-4680-01) contains two cluster cards with cables for converting two 7320 or two 7420 controllers to a cluster.

The following options are available for clustered storage controllers.

Note: When you cluster a 7320, you must identically configure the cards in both of the clustered storage controllers, and you must identically configure all optional NIC/HBA cards used in the clustered storage controllers in both chassis.

Slot	Type	Part Number	Vendor Part	Description	Note
0	PCIe	375-3617-01	Intel Niantic	DP Optical 10GE NIC	Optional Recommended Front-end
0	PCIe	375-3696-01	Mellanox	InfiniBand HCA	Optional Recommended Front-end
0	PCIe	375-3606-03	MHJH29-XTC	InfiniBand HCA	Optional Recommended Front-end
0	PCIe	375-3481-01	Intel EXPI9404PT	QP Copper NIC	Optional Recommended Front-end
0	PCIe	371-4325-01	QLogic	8Gb DP FC HBA	Optional FC Target or Initiator (Backup)
1	PCIe	542-0298-01	Sun	Fishworks Cluster Card 2	Cluster Base Configuration
2	PCIe	375-3609-03	Sun Thebe	External SAS HBA	Cluster Base Configuration

7320 Connector Pinouts

The serial management connector (SERIAL MGT) is an RJ-45 connector and is a terminal connection to the SP console.

The network management connector (NET MGT) is an RJ-45 connector on the motherboard and provides an alternate terminal interface to the SP console.

There are four RJ-45 Gigabit Ethernet connectors (NET0, NET1, NET2, NET3) located on the motherboard that operate at 10/100/1000 Mbit/sec. These network interfaces must be configured before use.

Attached Storage

The 7320 single and cluster controller configurations allow a single chain of one to six disk shelves. Any combination of disk-only and Logzilla-capable shelves may be combined within the chain in any order. The cabling configurations are unchanged. Half-populated shelf configurations are not supported.

See Also

- Controller Details
- Disk Shelf Overview
- Disk Shelf Maintenance Procedures

7420

7420 Hardware Overview

Use the information on this page as a preparation reference for servicing replaceable components of 7420 controllers.

Refer to the following for procedural instructions:

- Controller Tasks - replace system controller components
- Disk Shelf Tasks - replace disk shelf components

Appliance Overview

The Sun ZFS Storage 7420 Appliance consists of a standalone storage controller, or two storage controllers in a high-availability cluster configuration, and one to 36 disk shelves. The following table describes the 7420 configuration options:

Note: 7420 M2 controllers cannot be clustered with 7420 controllers.

Product ID	Mktg Part Number	CPU	DIMMs	Readzilla	Boot Drive	Mfg Part Number
7420 M2	7107089	4x8-core, 2.0GHz	8GB, 16GB	1.6TB SAS	900GB SAS	7075466
7420 M2	7107090	4x10-core, 2.40GHz	8GB, 16GB	1.6TB SAS	900GB SAS	7075470
7420	7100566	4x8-core, 2.0GHz	8GB, 16GB	512GB SATA	500GB SATA	7014572
7420	7100568	4x10-core, 2.40GHz	8GB, 16GB	512GB SATA	500GB SATA	7014573

You can identify your configuration by looking at the product id on the BUI Maintenance screen or by using the CLI `configuration version show` command. You can also check the physical label on the boot drive, as shown in the boot drive illustration below.

Refer to http://oracle.com/ZFSStorage (`http://oracle.com/ZFSStorage`) for the most recent component specification.

Chassis

The 3U chassis form factor dimensions are as follows:

Dimension	Measurement	Dimension	Measurement
Height	13.3 cm/5.25 in	Depth	70.6 cm/27.8 in
Width	43.7 cm/17.19 in	Weight	16.36 kg/96 lbs

Front Panel

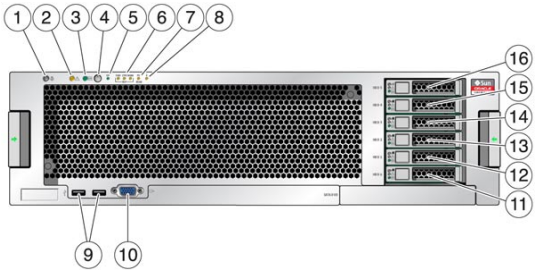


Figure Legend		
1 Locator LED and button (white)	**7** Power Supply (PS) Service Required LED	**13** SSD 2 (optional)
2 Service Required LED (amber)	**8** Over Temperature Warning LED	**14** SSD 3 (optional)
3 Power/OK LED (green)	**9** USB 2.0 Connectors	**15** SSD 4 (optional)
4 Power button	**10** DB-15 video connector	**16** SSD 5 (optional)
5 Service Processor (SP) OK LED (green)	**11** Boot drive 0 (mirrored)	
6 Fan/CPU/Memory Service Required LED	**12** Boot drive 1 (mirrored)	

System Drives

The 7420 M2 has two 900GB SAS-2 system boot drives in slots 0 and 1, configured as a mirrored pair. Up to four 1.6TB SAS-2 Readzilla SSDs may fill slots 2 through 5, in order. In a 7420 M2 cluster, the number of solid state drives (SSDs) installed in each controller can vary.

7420 controllers have two 500GB SATA system boot drives in slots 0 and 1, configured as a mirrored pair. Zero, two, three, or four 512GB SSDs, may optionally fill slots 2 through 5, in order. In a 7420 cluster, the number of SSDs installed in both controllers must match.

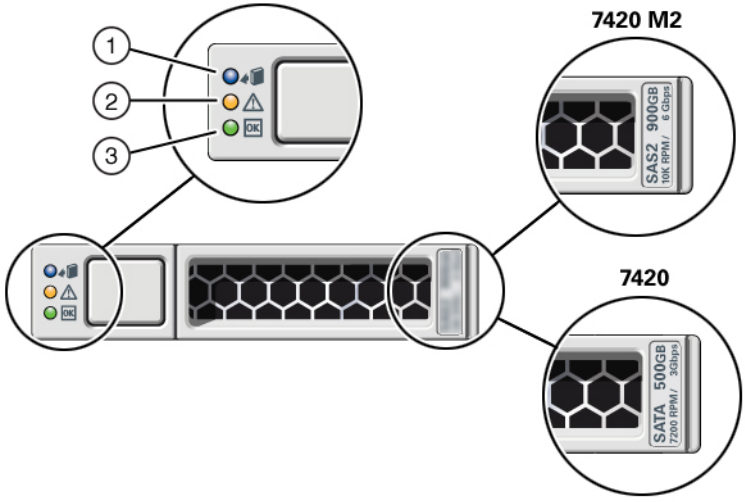


Figure Legend		
1 Locate (white)	**2** Service action required (amber)	**3** OK/Activity (green)

Rear Panel

The following graphic shows the rear panel of the controller. Base configuration HBAs are not depicted in this illustration.

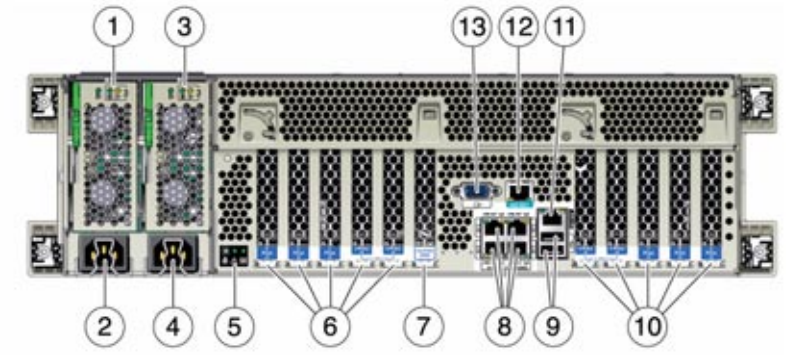


Figure Legend	
1 Power supply unit 0 status LEDs OK: green Power Supply Fail: amber AC OK: green	**8** Network (NET) 10/100/1000 ports: NET0-NET3
2 Power supply unit 0 AC inlet	**9** USB 2.0 ports
3 Power supply unit 1 status LEDs OK: green Power Supply Fail: amber AC OK: green	**10** PCIe slots 5-9
4 Power supply unit 1 AC inlet	**11** Network management (NET MGT) port
5 System status LEDs Power: green Attention: amber Locate: white	**12** Serial management (SER MGT) port
6 PCIe slots 0-4	**13** DB-15 video connector
7 Cluster card slot	

Connectors

The serial management connector (SER MGT) is an RJ-45 connector and provides a terminal connection to the SP console.

The network management connector (NET MGT) is an RJ-45 connector and provides a LAN interface to the SP console.

There are four RJ-45 Gigabit Ethernet connectors (NET0, NET1, NET2, NET3) located on the motherboard that operate at 10/100/1000 Mbit/sec. These network interfaces must be configured before use.

Electrical Specifications

The following list shows the electrical specifications for 7420 controllers.

Note: The power dissipation numbers listed are the maximum rated for the power supply and are not a rating of the actual power consumption of the appliance.

Input

- Nominal frequencies: 50/60Hz
- AC operating range: 100-127 VAC for 2 CPUs and 200-240 VAC for 2 or 4 CPUs
- Maximum current AC RMS: 12A @ 100 VAC / 12A @ 200 VAC

Power Dissipation

- Max power consumption: 1800 W
- Max heat output: 6143 BTU/hr
- Volt-Ampere rating: 1837 VA @ 240 VAC, 0.98 P.F.

Internal Boards

The 7420 controller chassis has the following boards installed. Field-replaceable units (FRUs) should only be replaced by trained Oracle service technicians.

- **Motherboard** - The motherboard is a FRU and includes CPU modules, slots for eight DIMM risers, memory control subsystems, and the service processor (SP) subsystem. The SP subsystem controls the host power and monitors host system events (power and environmental). The SP controller draws power from the host's 3.3V standby supply rail, which is available whenever the system is receiving AC input power, even when the system is turned off.
- **Power Distribution Board** - The power distribution board is a FRU and distributes main 12V power from the power supplies to the rest of the system. It is directly connected to the Vertical PDB card, and to the motherboard through a bus bar and ribbon cable. It also supports a top cover interlock ("kill") switch. In the storage controller, the power supplies connect to the power supply backplane which connects to the power distribution board.
- **Vertical PDB Card** - The vertical power distribution board, or Paddle Card is a FRU and serves as the interconnect between the power distribution board and the fan power boards, hard drive backplane, and I/O board.
- **Power Supply Backplane Card** - This board connects the power distribution board to power supplies 0 and 1.

- **Fan Power Boards** - The two fan power boards are FRUs and carry power to the storage controller fan modules. In addition, they contain fan module status LEDs and transfer I2C data for the fan modules.
- **Drive Backplane** - The six-drive backplane is a FRU and includes the connectors for the drives, as well as the interconnect for the I/O board, Power and Locator buttons, and system/component status LEDs. Each drive has an LED indicator for Power/Activity, Fault, and Locate.

Components

The controller components are shown in the following figure and identified in the table.

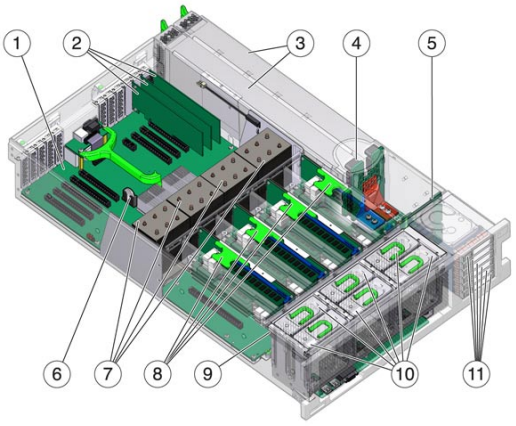


Figure Legend	
1 Motherboard	**7** CPUs and heatsinks
2 Low-profile PCIe cards	**8** Memory risers
3 Power supplies	**9** Fan board
4 Power supply backplane	**10** Fan modules
5 Drive backplane	**11** Boot drives and SSDs
6 System lithium battery	

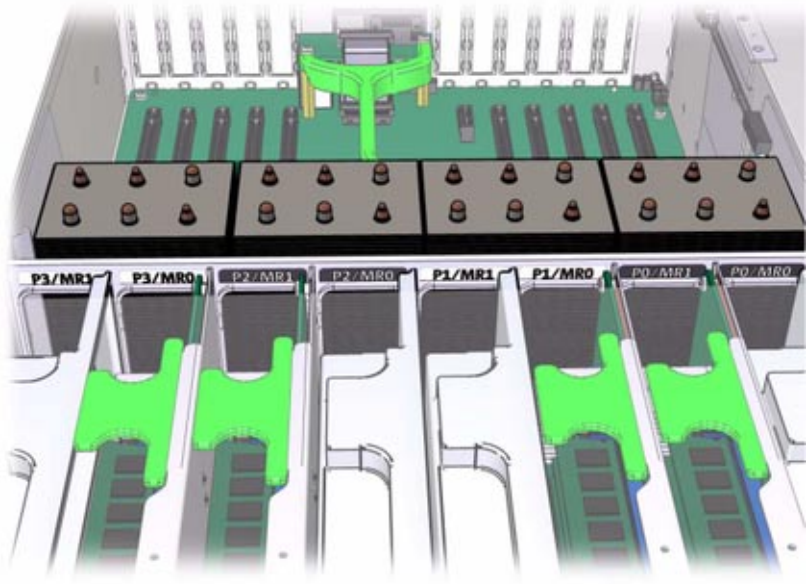
CPU and Memory

The 7420 controller supports the following configurations:

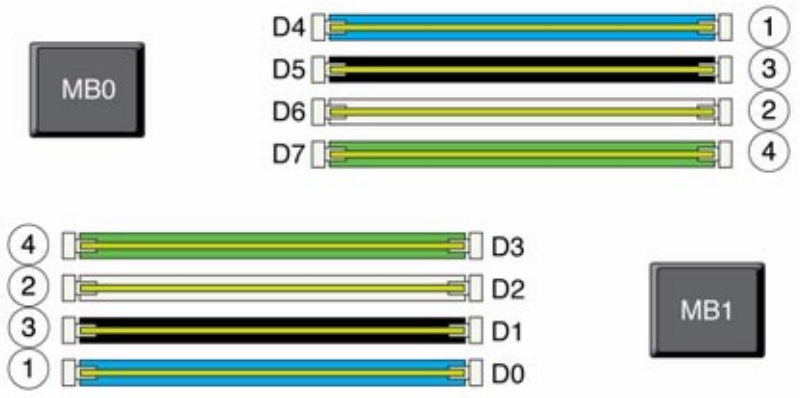
- Two, four, or eight 8GB DDR3 DIMMs installed on each riser, accommodating 128GB, 256GB, or 512GB of memory for 2.0Ghz CPUs.
- Four or eight 8GB DDR3 DIMMs installed on each riser, accommodating 256GB or 512GB of memory for 2.0GHz and 2.4Ghz CPUs.
- Four or eight 16GB DDR3 DIMMs installed on each riser, accommodating 512GB or 1TB of memory for 2.4Ghz CPUs.

Note: For proper cooling, memory risers corresponding to unpopulated CPU sockets must have fillers installed.

Previous 7420 controller configurations support two or four (1.86GHz or 2.00GHz) CPUs, with two memory risers required by each CPU. Four or eight 4GB or 8GB DDR3 DIMMs are installed on each riser, accommodating up to 256GB of memory for two CPUs, or up to 512GB for four CPUs.



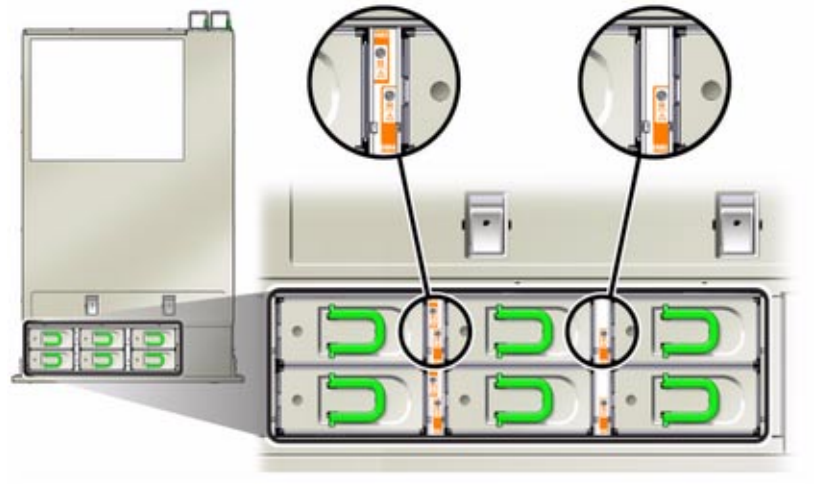
Refer to the service label on the cover for DIMM placement information. On every memory riser, slots D0, D2, D4, and D6 must be populated; optionally, slots D1, D3, D5, and D7 may be populated as a group on **all** installed memory risers. All DIMMs in the system **must be identical**.



DIMM names in appliance logs and the Maintenance > Hardware view are displayed with the full name, such as /SYS/MB/P0/D7.

Fan Modules

The Fan Modules and Fan Module LEDs of the storage controller are shown in the following figure. The following LEDs are lit when a fan module fault is detected:



- Front and rear Service Action Required LEDs
- Fan Module Service Action Required (TOP) LED on the front of the server
- Fan Fault LED on or adjacent to the faulty fan module

The system Overtemp LED might light if a fan fault causes an increase in system operating temperature.

NIC/HBA Options

This table describes NIC/HBA PCIe card options for standalone and cluster configurations.

Mktg Part Number	Description	Mfg Part Number
SGX-SAS6-INT-Z	8-port 6Gb/s SAS-2 internal HBA	7054001
SG-XPCIE2FC-QF8-Z	2-port 8Gb FC HBA	371-4325-02
SG-XPCIESAS-GEN2-Z	2-port SAS (x4) external HBA	F375-3609-03
7105394	2-port SAS (x4) external HBA for EU countries	7059331
X4446A-Z-N	4-port GigE UTP	7054739
X4242A	2-port CX2 4xQDR, HCA	594-6776-01
X1109A-Z	2-port 10GbE SFP+ NIC	7051223
X2129A	XCVRm 850NM, 1/10GPS, Short Reach, SFP	7015839
X5562A-Z	10GbE/1GbE SFP+ Transceiver, LR	594-6689-01

PCIe Options

The 7420 controller has ten PCIe slots. This table describes base and optional PCIe card slots for standalone and cluster configurations.

Note: The 7420 M2 reserves slot 0 for a SAS-2 internal HBA, and slots 1 and 8 for two SAS-2 external HBAs.

Slot	Mfg Part Number	Description	Max	Note
0	7054001	8-port 6Gb/s SAS-2 internal HBA	1	Slot 0 of the 7420 M2 is reserved for the SAS-2 internal HBA
0	371-4325-02	8Gb 2-port FC HBA	6	Optional FC target or initiator (Backup) for the 7420 controller
0	7051223	2-port optical 10GbE NIC	6	Optional recommended front-end for the 7420 controller
0	7054739	4-port copper NIC	6	Optional recommended front-end for the 7420 controller
1	F375-3609-03 (7059331 for EU countries)	2-port SAS external HBA	6	Base configuration (2 minimum)
2	F375-3609-03 (7059331 for EU countries)	2-port SAS external HBA	6	Additional optional back-end
2	7054739	4-port copper NIC	6	Optional recommended front-end

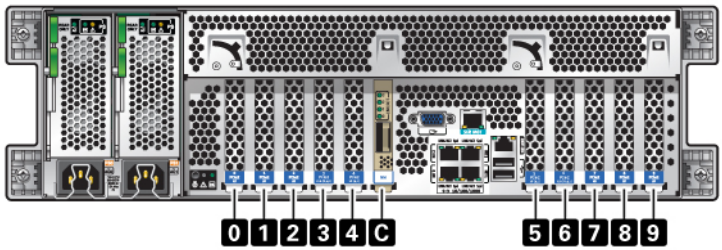
Slot	Mfg Part Number	Description	Max	Note
2	371-4325-02	8Gb DP FC HBA	6	Optional FC target or initiator (Backup)
2	375-3606-03	CX1 Infiniband HCA	4	Optional recommended front-end
2	7051223	2-port optical 10GE NIC	6	Optional recommended front-end
2	375-3696-01	CX2 Infiniband HCA	4	Optional recommended front-end
3	F375-3609-03 (7059331 for EU countries)	2-port SAS external HBA	6	Additional optional back-end
3	7054739	4-port copper NIC	6	Optional recommended front-end
3	371-4325-02	8Gb 2-port FC HBA	6	Optional FC target or initiator (Backup)
3	375-3606-03	CX1 Infiniband HCA	4	Optional recommended front-end
3	7051223	2-port optical 10GE NIC	6	Optional recommended front-end
3	375-3696-01	CX2 Infiniband HCA	4	Optional recommended front-end
4	7054739	4-port copper NIC	6	Optional recommended front-end
4	375-3606-03	CX1 Infiniband HCA	4	Optional recommended front-end
4	7051223	2-port optical 10GE NIC	6	Optional recommended front-end
4	371-4325-02	8Gb 2-port FC HBA	6	Optional FC target or initiator (Backup)
4	375-3696-01	CX2 Infiniband HCA	4	Optional recommended front-end
C	7056175	Cluster Controller 200	1	Cluster base configuration
5	7054739	4-port copper NIC	6	Optional recommended front-end
5	375-3606-03	CX1 Infiniband HCA	4	Optional recommended front-end
5	7051223	2-port optical 10GE NIC	6	Optional recommended front-end
5	371-4325-02	8Gb 2-port FC HBA	6	Optional FC target or initiator (Backup)
5	375-3696-01	CX2 Infiniband HCA	4	Optional recommended front-end
6	F375-3609-03 (7059331 for EU countries)	2-port SAS external HBA	6	Additional optional back-end
6	7054739	4-port copper NIC	6	Optional recommended front-end
6	371-4325-02	8Gb 2-port FC HBA	6	Optional FC target or initiator (Backup)
6	375-3606-03	CX1 Infiniband HCA	4	Optional recommended front-end
6	7051223	2-port optical 10GE NIC	6	Optional recommended front-end

Slot	Mfg Part Number	Description	Max	Note
6	375-3696-01	CX2 Infiniband HCA	4	Optional recommended front-end
7	F375-3609-03 (7059331 for EU countries)	DP SAS external HBA	6	Additional optional back-end
7	7054739	4-port copper NIC	6	Optional recommended front-end
7	371-4325-02	8Gb 2-port FC HBA	6	Optional FC target or initiator (Backup)
7	375-3606-03	CX1 Infiniband HCA	4	Optional recommended front-end
7	7051223	2-port optical 10GE NIC	6	Optional recommended front-end
7	375-3696-01	CX2 Infiniband HCA	4	Optional recommended front-end
8	F375-3609-03 (7059331 for EU countries)	2-port SAS external HBA	6	Base configuration (2 minimum)
9	371-4325-02	8Gb 2-port FC HBA	6	Optional FC target or initiator (Backup)
9	7051223	2-port optical 10GbE NIC	6	Optional recommended front-end
9	7054739	4-port copper NIC	6	Optional recommended front-end

PCIe Slot Order

When installing additional PCIe cards to your base 7420 configuration, cards must be added in a specific order.

Note: The 7420 M2 reserves slot 0 for a SAS-2 internal HBA, and slots 1 and 8 for two SAS-2 external HBAs (see PCIe Options).



Install optional PCIe cards in the following order:

PCIe Card	Slot Order
1. SAS-2 external HBA	Slot 2, 7, 3, 6
2. 8Gb FC HBA	Slot 9
	Additional FC HBAs are installed last
3. Infiniband HCAs	Slot 7, 2, 6, 3, 5, 4
4. 10Gb Ethernet	Slot 7, 2, 6, 3, 5, 4, 0 (not available for 7420 M2), 9
5. Quad 1Gb Ethernet	Slot 7, 2, 6, 3, 5, 4, 0 (not available for 7420 M2), 9
6. Remaining 8Gb FC HBAs	Slot 7, 2, 6, 3, 5, 4, 0 (not available for 7420 M2)

Attached Storage

Primary storage for 7420 controllers is provided by one to six chains of attached storage. Each chain consists of up to six HDD-only or SSD-capable disk shelves, combined in any order.

See Disk Shelf Overview for component specifications and diagrams.

7x20

7x20 CRU Maintenance Procedures

This section provides instructions on how to replace customer replaceable components (CRUs) in Oracle's Sun ZFS Storage 7120, 7320, and 7420 controllers.

Refer to Disk Shelf Details for replacing expansion storage shelf components.

Prerequisites

- Read the information in the overview section for your controller to become familiar with the replaceable parts of the system: 7120 | 7320 | 7420
- Follow the instructions in the Safety Information and Required Tools and Information sections.

Safety Information

This section contains safety information that you must follow when servicing the storage system. For your protection, observe the following safety precautions when setting up your equipment:

- Do not remove the side panels, or run the storage system with the side panels removed. Hazardous voltage is present that could cause injury. The covers and panels must be in place for proper air flow to prevent equipment damage.
- Follow all cautions, warnings, and instructions marked on the equipment and described in Important Safety Information for Sun Hardware Systems.
- Ensure that the voltage and frequency of your power source match the voltage inscribed on the electrical rating label.
- Follow the electrostatic discharge safety practices. Electrostatic discharge (ESD) sensitive devices, such as PCI cards, HDDs, SSDs, and memory cards, require special handling. Circuit boards and HDDs contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Do not touch the components without using antistatic precautions, especially along the connector edges.

Required Tools and Information

The following tools are needed to service the CRUs:

- Antistatic wrist strap - Wear an antistatic wrist strap and use an antistatic mat when handling components such as HDDs or PCI cards. When servicing or removing storage controller components, attach an antistatic strap to your wrist and then to a metal area on the chassis. Following this practice equalizes the electrical potentials between you and the storage controller.
- Antistatic mat - Place static-sensitive components on an antistatic mat.
- No. 2 Phillips screwdriver
- Nonconducting, No.1 flat-blade screwdriver or equivalent
- Nonconducting stylus or pencil (to power on the storage controller)

Chassis Serial Number

To obtain support for your storage controller or to order new parts, you need your chassis serial number. You can find a chassis serial number label on the storage controller front panel on the left side. Another label is on the top of the storage controller. Alternatively, click the Sun logo in the BUI masthead to obtain the serial number or issue the following command:

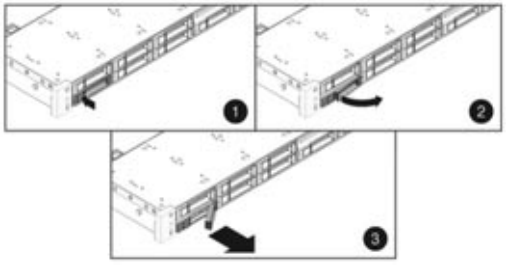
```
hostname: maintenance hardware show
```

Controller Replacement Tasks

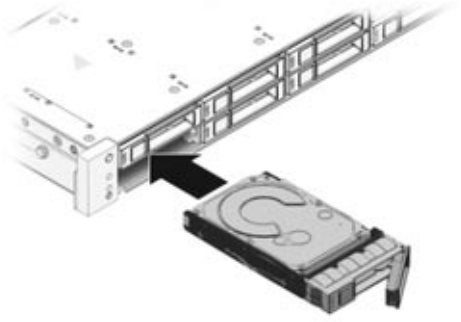
7x20 Controller Replacement Tasks

HDD or SSD

1. Identify the failed HDD or SSD by going to the Maintenance > Hardware section of the BUI and clicking the drive details icon . If you are physically at the system, the amber Service Required indicator on the HDD or SSD should be illuminated.
2. If you are not physically at the system, turn on the locator indicator by clicking the locator icon .
3. Push the release button on the HDD or SSD to open the latch.
4. Grasp the latch (2), and pull the drive out of the drive slot.



5. After 15 seconds, navigate to the Hardware > Maintenance screen, and click the details icon on the system controller to verify that the software has detected that the drive is not present.
6. Slide the replacement drive into the slot until it is fully seated.



7. Close the latch to lock the drive in place.

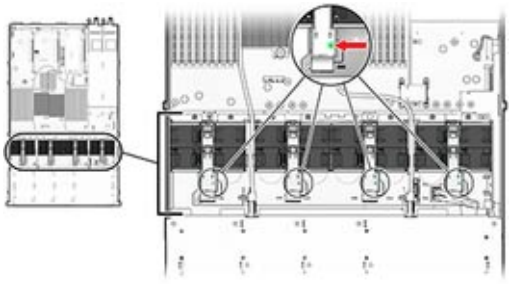
The Sun ZFS Storage system software automatically detects and configures the new drive. The device appears in the BUI Maintenance > Hardware screen when you view details for the controller or drive shelf.

Fan Module

Fan modules are hot-swappable and can be removed and installed while the storage controller is running without affecting other hardware capabilities.

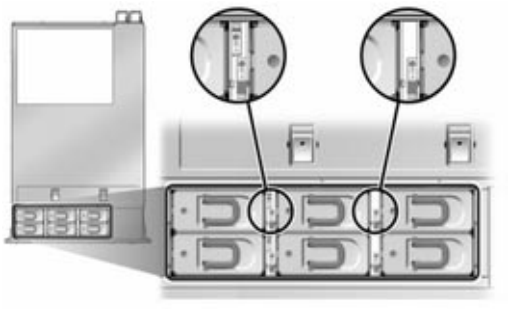
Caution: Operating a controller for an extended period of time with fans removed reduces the effectiveness of the cooling system. For this reason, the replacement fan should be unpacked in advance and ready to insert into the controller chassis as soon as the faulted fan is removed.

7120 or 7320: The fan modules and status indicators are hidden under a fan door in the 7120 and 7320 storage controllers. Components may differ slightly between the 7120 and 7320, however service procedures for each are identical. The illustration shows the 7320.



Leaving the door open for more than 60 seconds while the storage controller is running might cause it to overheat and shut down.

7420: The following illustration shows the fan modules in the 7420 storage controller.

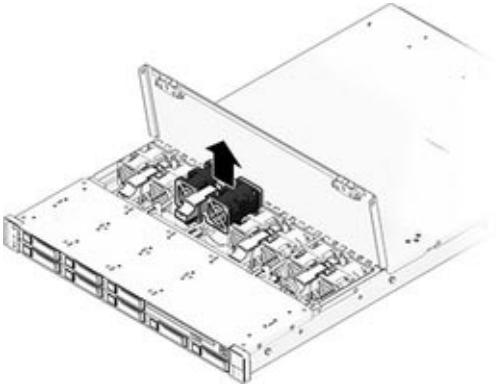


1. To locate the chassis you want to service, click the associated locate icon on the Maintenance > Hardware screen of the BUI or issue the **`set /SYS/LOCATE status=on`** command at the service processor (SP) prompt. The locate LED will flash on the controller chassis.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.
4. While squeezing the slide release latches, slowly pull the storage controller forward until the slide rails latch.
5. **`7120 or 7320:`** To replace the fan module:

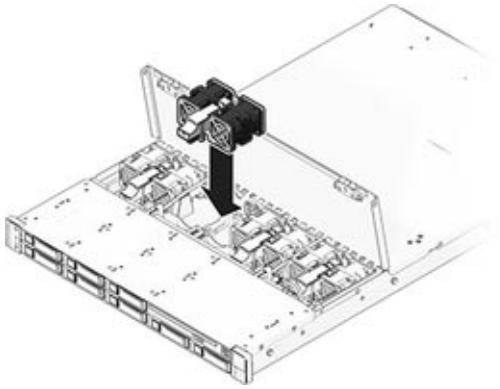
   Open the fan module door while unlatching the release tabs on the door.

   Identify the faulted fan module by locating the corresponding Service Required status indicator or by clicking the locate icon on Maintenance > Hardware screen of the BUI for the fan you want to replace.

   Using thumb and forefinger, pull the fan module up and out.



Install the replacement fan module into the storage controller fan slot. **Note**: The fan must be replaced within one minute to avoid controller shutdown.



Apply firm pressure to fully seat the fan module.

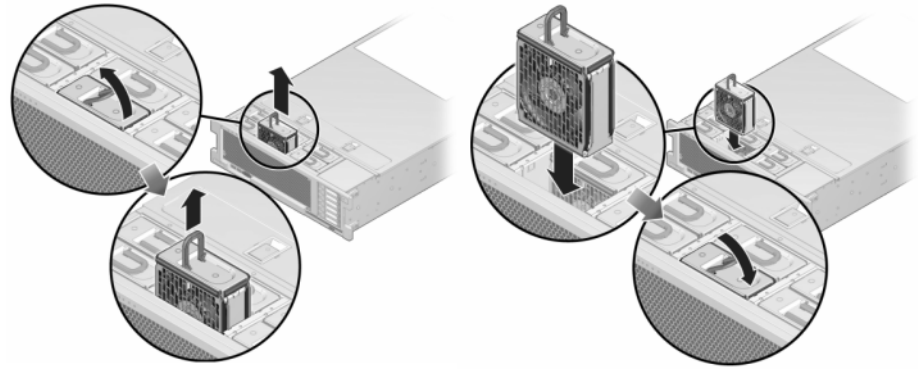
Verify that the Fan OK status indicator is lit, and that the fault status indicator on the replaced fan module is dim.

Close the top cover door immediately after replacing the fan to maintain airflow in the storage controller.

6. **7420** To replace the fan module:

   Identify the faulted fan module by locating the corresponding Service Required status indicator or by clicking the ☼ locate icon on Maintenance > Hardware screen of the BUI for the fan you want to replace.

   Lift the latch at the top of the fan module to unlock the fan module, and pull the fan module out.



   Unlock and insert the 7420 fan module.

   Apply firm pressure to fully seat the fan module.

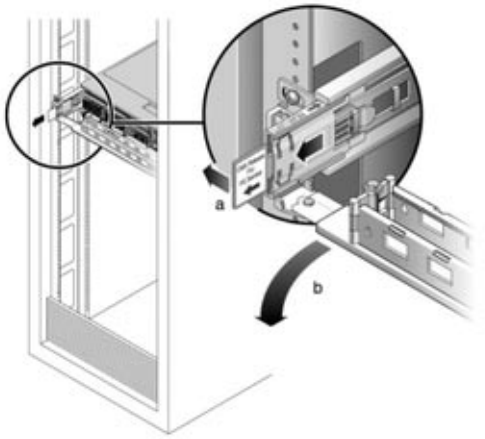
Verify that the Fan OK status indicator is lit and that the fault status indicator on the replaced fan module is dim.

7. Verify that the Top Fan status indicator, the Service Required status indicators, and the Locator status indicator/Locator button are dim.
8. Push the release tabs on the side of each rail and slowly slide the storage controller into the rack.

Power Supply

Storage controllers are equipped with redundant hot-swappable power supplies. If a power supply fails and you do not have a replacement, leave the failed power supply installed to ensure proper air flow. A faulted power supply is indicated by an amber colored status LED.

1. Gain access to the rear of the storage controller where the faulted power supply is located.
2. If a cable management arm (CMA) is installed, press and hold the CMA release tab and



rotate the arm out of the way.

3. Disconnect the power cord from the faulted power supply.
4. Remove the power supply.

7120 or 7320: Release the latch, then remove the power supply. Components may differ slightly between the 7120 and 7320, however service procedures for each are identical. The

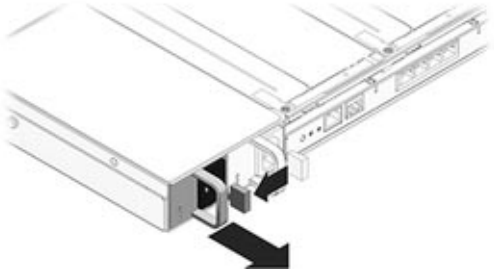
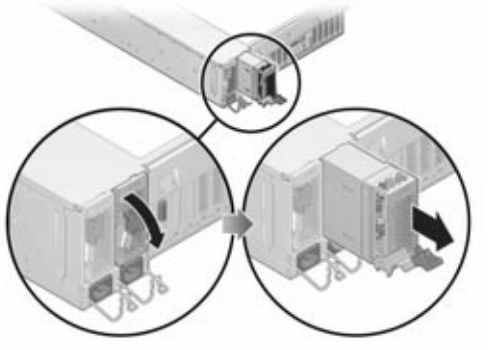
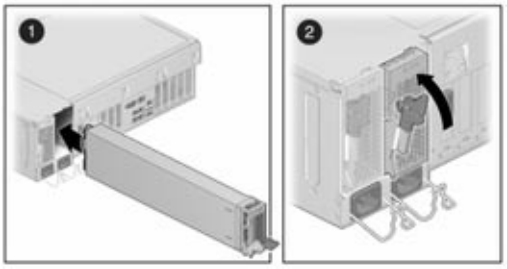


illustration shows the 7320.

7420: Grasp the power supply handle and press the release latch to remove the power supply.



5. Align the replacement power supply with the empty power supply chassis bay.
6. Slide the power supply into the bay until it is fully seated. The following figure shows the 7420 power supply.



7. Connect the power cord to the power supply.
8. Verify that the green AC Present status indicator is lit.
9. Close the CMA, inserting the CMA into the rear left rail bracket.
10. Go to the Maintenance > Hardware screen of the BUI. Click details icon for the controller and then click power supply to verify that the status icon is green for the newly installed power supply.

Memory

To identify a specific memory module that has faulted, you must open the storage controller and use the amber status LEDs on the motherboard. To identify a general memory fault, go to the Maintenance > Hardware screen of the BUI, and click on the details icon on the controller. Then click DIMMs to locate the faulted component, indicated by the warning icon .

Caution: This procedure requires that you handle components that are sensitive to static discharge, which can cause the component to fail. To avoid damage, wear an antistatic wrist strap and use an antistatic mat when handling components.

You **must** shut down the appliance before beginning this task. Note that there will be a loss of access to the storage unless the system is in a clustered configuration. Shut down the appliance using one of the following methods:

- Log in to the BUI and click the power icon on the left side of the masthead.
- SSH into the appliance and issue the **maintenance system poweroff** command.
- SSH or serial console into the service processor (SP) and issue the **stop /SYS** command.
- Use a pen or nonconducting pointed object to press and release the Power button on the front panel.
- To initiate emergency shutdown during which all applications and files will be closed abruptly without saving, press and hold the power button for at least four seconds until the Power/OK status indicator on the front panel flashes, indicating that the storage controller is in standby power mode.

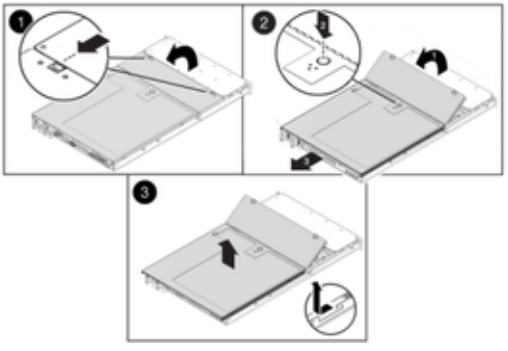
1. Disconnect the AC power cords from the rear panel of the storage controller.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.
4. While squeezing the slide release latches, slowly pull the storage controller forward until the slide rails latch.
5. **7120 or 7320:** Components may differ slightly between the 7120 and 7320, however service procedures for each are identical. The illustration shows the 7320. To remove the top cover:

   Unlatch the fan module door, pull the two release tabs back, rotate the fan door to the open position and hold it there.

   Press the top cover release button and slide the top cover to the rear about a half-inch (1.3 cm).

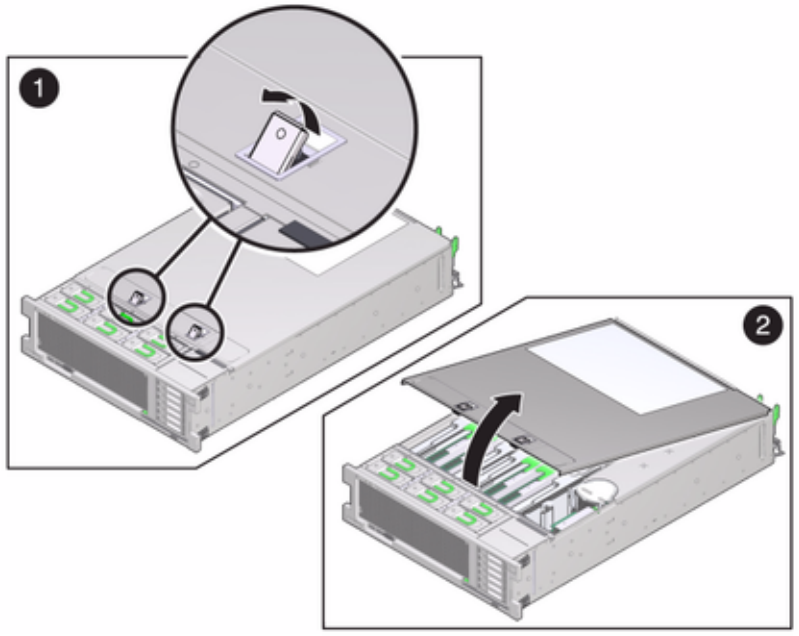
   Lift up and remove the top cover.

   Also remove the air baffle by pressing the air baffle connectors outward and lifting the air baffle up and out of the server.



6. **7420:** To remove the top cover:

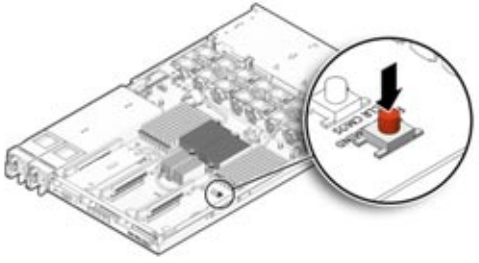
Simultaneously lift both cover latches in an upward motion.



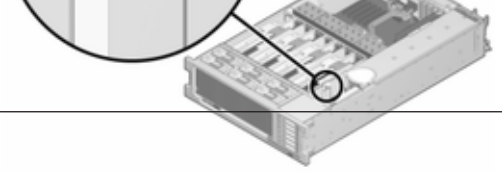
Lift up and remove the top cover.

7. To locate the DIMM you want to service, press the Fault Remind Button on the storage controller.

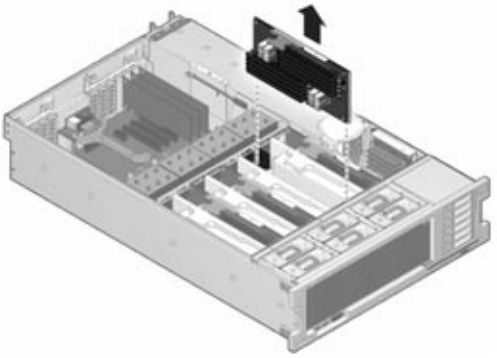
   The following illustration shows the Fault remind button on the 7120.



The following illustration shows the Fault remind button on the 7420.

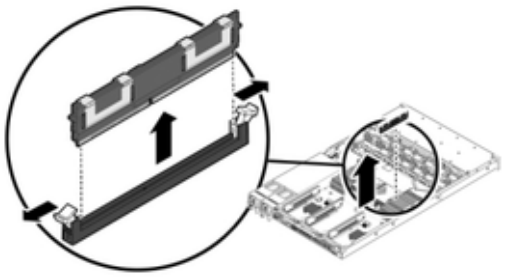


8. **7420:** Identify the memory riser that hosts the faulted DIMM by the Service Required status indicator. Lift the memory riser straight up to remove it from the motherboard, and place it

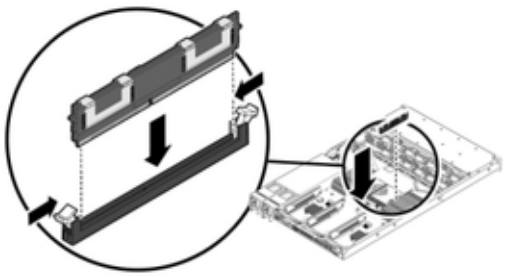


on an antistatic mat.

9. Rotate both DIMM slot ejectors outward as far as they will go and carefully lift the faulted DIMM straight up to remove it from the socket.



10. Line up the replacement DIMM with the connector, aligning the notch with the key to ensure that the component is oriented correctly.

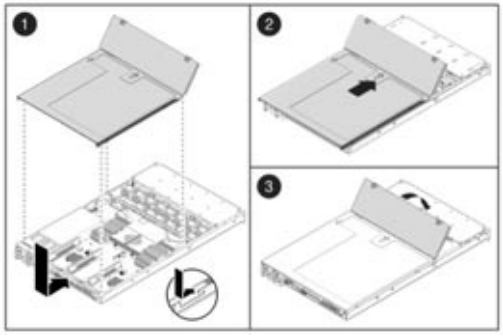


11. Push the DIMM into the connector until the ejector tabs lock the component in place.
12. **7120 or 7320:** Components may differ slightly between the 7120 and 7320, however service procedures for each are identical. The illustration shows the 7320. To replace the cover:

    Place the top cover on the chassis so that it hangs over the rear of the storage controller by about an inch (2.5 cm).

Slide the top cover forward until it seats.

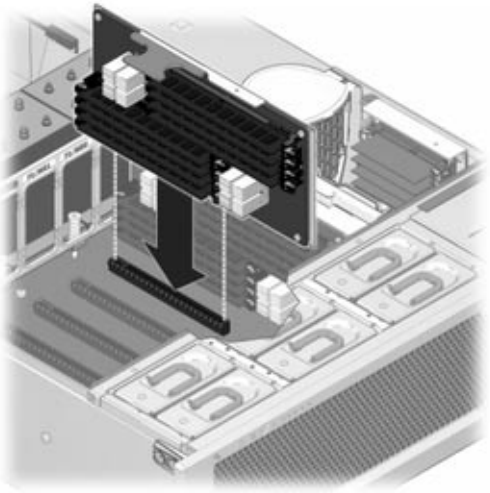
Close the fan cover and engage the fan cover latches. The cover must be completely closed



for the storage controller to power on.

13. **7420:** To replace the cover:

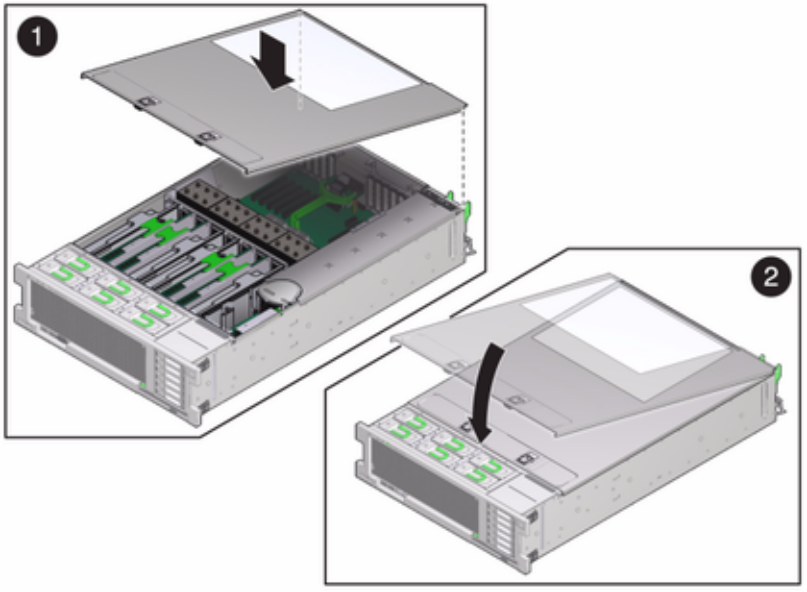
    Push the memory riser module into the associated CPU memory riser slot until the riser



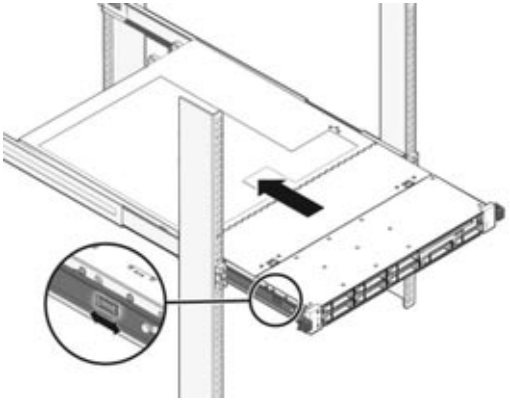
    module locks in place.

    Place the top cover on the chassis so that it is forward of the rear of the storage controller by about an inch (2.5 cm).

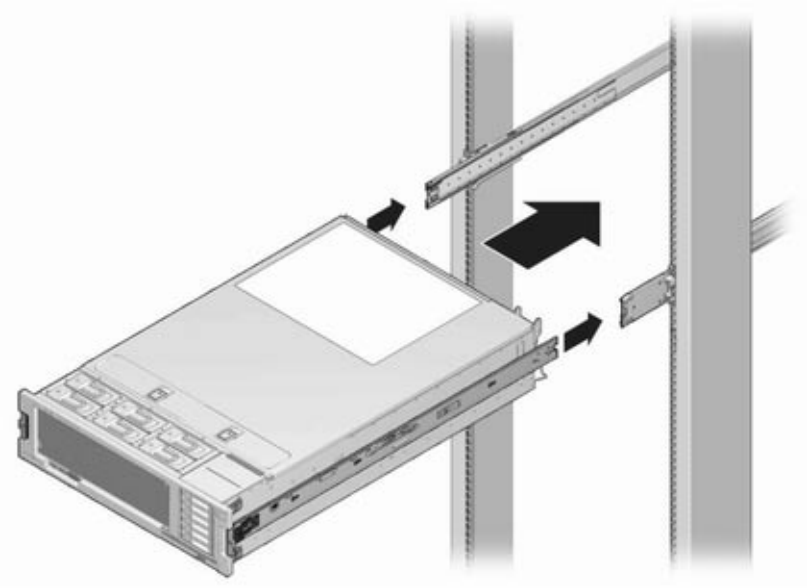
Slide the top cover toward the rear of the chassis until it seats and press down on the cover with both hands until both latches engage.



14. Push the release tabs on the side of each rail and slowly push the storage controller into the rack.



The following image shows the 7420 chassis.



15. Connect the power cords to the power supplies.
16. Verify that standby power is on, indicated by the Power/OK status indicator flashing on the front panel about two minutes after the power cords are plugged in.
17. Use a pen or other pointed object to press and release the recessed Power button on the storage controller front panel.

The Power/OK status indicator next to the Power button lights and remains lit. The Maintenance > Hardware screen of the BUI provides status of the replacement on the Details page for DIMMs.

PCIe Cards and Risers

Go to the Maintenance > Hardware screen of the BUI and click the details icon on the controller, and then click Slots to locate the faulted component.

Caution: This procedure requires that you handle components that are sensitive to static discharge, which can cause the component to fail. To avoid damage, wear an antistatic wrist strap and use an antistatic mat when handling components.

Note that the 7120 Sun Flash Accelerator F20 card is a FRU and **must** be replaced by an Oracle service representative.

All HBAs must be of the same type. Ensure that you upgrade your system software before installing a newly-released HBA.

You **must** shut down the controller before beginning this task. Note that there will be a loss of access to the storage unless the system is in a clustered configuration. Shut down the appliance using one of the following methods:

- Log in to the BUI, and click the power icon on the left side of the masthead.
- SSH into the storage system and issue the **maintenance system poweroff** command.
- SSH or serial console into the service processor (SP) and issue the **stop /SYS** command.
- Use a pen or non-conducting pointed object to press and release the Power button on the front panel.
- To initiate emergency shutdown, wherein all applications and files will be closed abruptly without saving, press and hold the power button for at least four seconds until the Power/OK status indicator on the front panel flashes, indicating that the storage controller is in standby power mode.

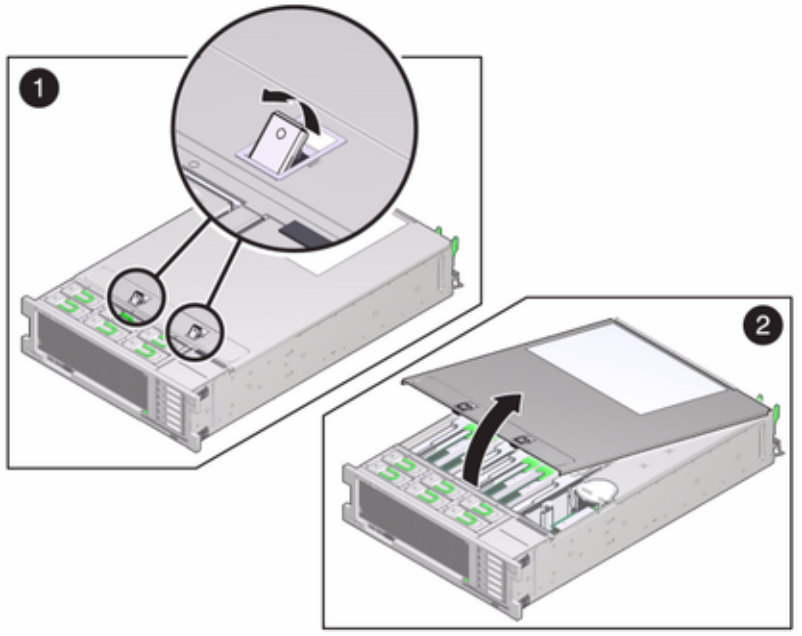
1. Disconnect the AC power cords from the rear panel of the storage controller.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.
4. While squeezing the slide release latches, slowly pull the storage controller forward until the slide rails latch.
5. **7120 or 7320:** To remove the top cover:

   Unlatch the fan module door, pull the two release tabs back, rotate the fan door to the open position and hold it there.

   Press the top cover release button and slide the top cover to the rear about a half-inch (1.3 cm).

   Lift up and remove the top cover.
6. **7420:** To remove the top cover:

Simultaneously lift both cover latches in an upward motion.

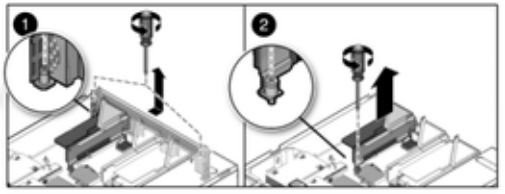


Lift up and remove the top cover.

7. Locate the PCIe card position in the storage controller, see Single and Cluster Controller Configurations for the 7320, the 7120 Overview, or 7420 Overview.
8. **7120 or 7320:** To replace the PCIe card:

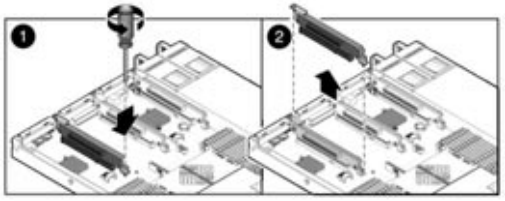
   Disconnect any data cables connected to the cards on the PCIe riser you want to replace. Label the cables for proper connection later.

   Loosen the two captive Phillips screws on the end of the rear panel crossbar and lift the crossbar up and back to remove it.

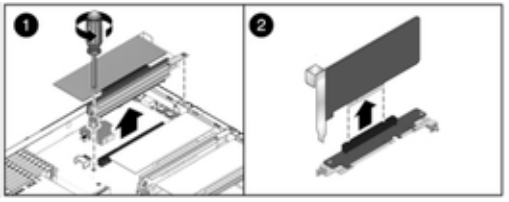


   Loosen the captive retaining screw holding the front end of the riser and the Phillips screw on the end of the riser.

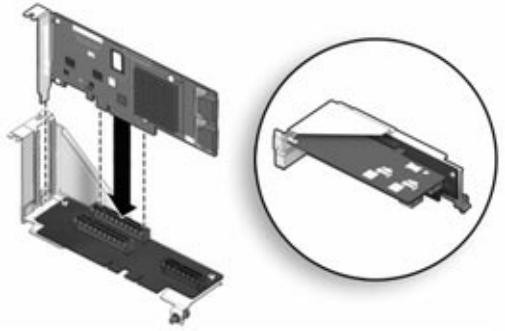
Lift the riser up to remove it from the storage controller.



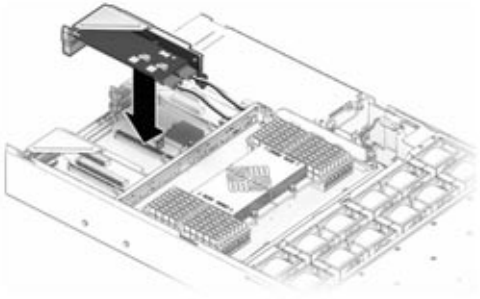
Carefully remove the PCIe card from the riser board connector and clean the slot with filtered, compressed air if necessary.



Seat the replacement PCIe card in the slot of the riser and connect the cables.



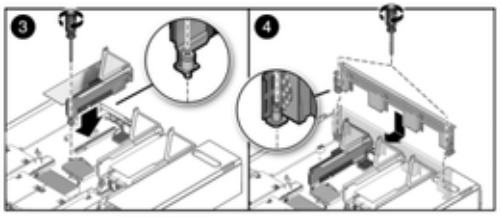
Align the riser, together with any attached PCIe cards, with the intended location on the motherboard, and carefully insert it into its slot.



Slide the back of the riser into the motherboard rear panel stiffener.

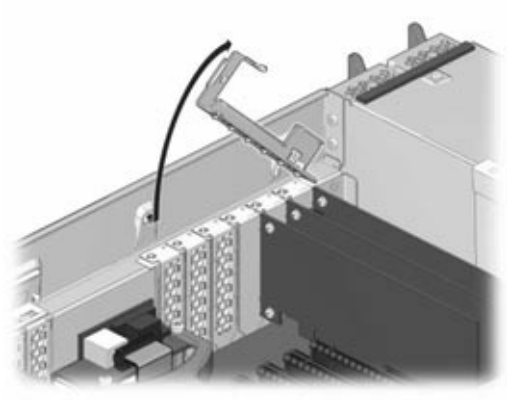
Tighten the screw that secures the riser to the motherboard.

Replace the rear panel PCI crossbar by sliding it down over the PCIe risers, ensuring the crossbar is secured with two captive Phillips screws.



9. **7420:** To replace the PCIe card:

   Disengage the PCIe card slot crossbar from its locked position and rotate the crossbar into



   an upright position.

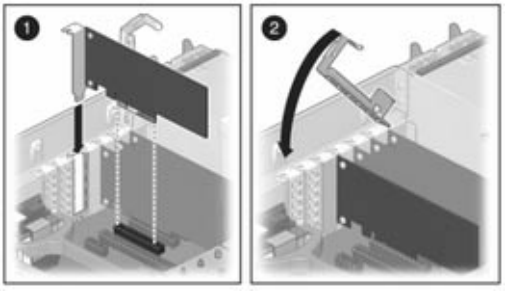
   Remove the retaining screw that holds the PCIe card to the chassis.

   Carefully remove the PCIe card from the connector and clean the slot with filtered, compressed air if necessary.

   Install the replacement PCIe card into the PCIe card slot.

   Install the retaining screw to hold the PCIe card to the chassis.

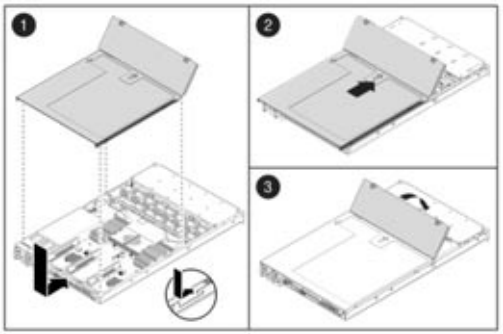
   Return the crossbar to its closed and locked position.



10. **7120 or 7320:** Components may differ slightly between the 7120 and 7320, however service procedures for each are identical. The illustration shows the 7320. To install the top cover:

    Place the top cover on the chassis so that it hangs over the rear of the storage controller by about an inch (2.5 cm), then slide the top cover forward until it seats.

    Close the fan cover and engage the fan cover latches. The cover must be completely closed for the storage controller to power on.

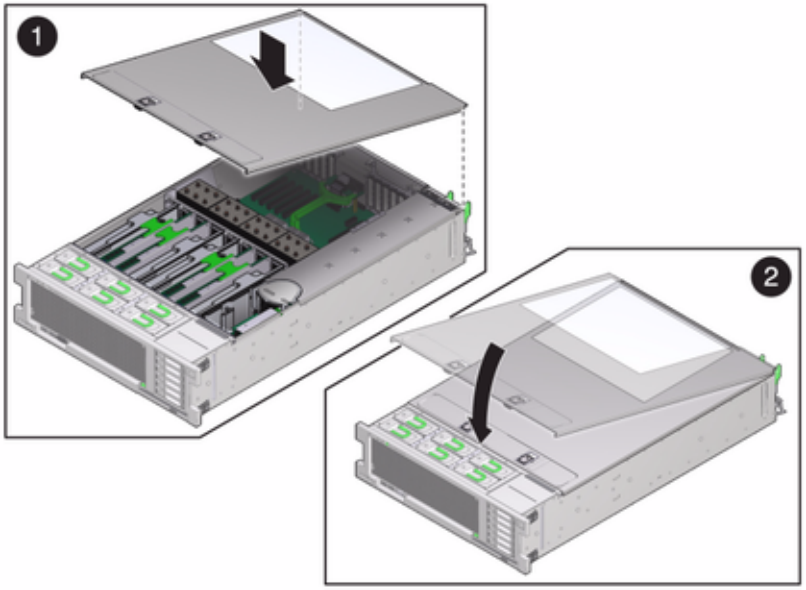


11. **7420:** To install the top cover:

    Place the top cover on the chassis (1) so that it is forward of the rear of the storage controller by about an inch (2.5 cm).

    Slide the top cover toward the rear of the chassis (2) until it seats.

    Press down on the cover with both hands until both latches engage.



12. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.

13. Connect the power cords to the power supplies.
14. Verify that standby power is on, indicated by the Power/OK status indicator flashing on the front panel about two minutes after the power cords are plugged in.
15. Use a pen or other pointed object to press and release the recessed Power button on the storage controller front panel. The Power/OK status indicator next to the Power button lights and remains lit.
16. Connect data cables to the PCIe card, routing them through the cable management arm.
17. Go to the Maintenance > Hardware screen of the BUI, and click the details icon on the controller. Then, click Slots to verify the status of the new component. The status indicator should appear green .
18. Install the disk shelf and connect the expansion storage.

Battery

You might need to replace the battery if the storage controller fails to maintain the proper time when powered off and disconnected from the network. You will need a small (No.1 flat-blade) non-metallic screwdriver or equivalent.

You **must** shut down the appliance before beginning this task. Note that there will be a loss of access to the storage unless the system is in a clustered configuration. Shut down the appliance using one of the following methods:

- Login to the BUI and click the power icon on the left side of the masthead.
- SSH into the storage system and issue the **maintenance system poweroff** command.
- SSH or serial console into the service processor and issue the **stop /SYS** command.
- Use a pen or non-conducting pointed object to press and release the Power button on the front panel.
- To initiate emergency shutdown, wherein all applications and files will be closed abruptly without saving, press and hold the power button for at least four seconds until the Power/OK status indicator on the front panel flashes, indicating that the storage controller is in standby power mode.

1. Disconnect the AC power cords from the rear panel of the storage controller.
2. Verify that no cables will be damaged or will interfere when the storage controller is extended from the rack.
3. From the front of the storage controller, release the two slide release latches.
4. While squeezing the slide release latches, slowly pull the storage controller forward until the slide rails latch.
5. **7120 or 7320:** To remove the top cover:

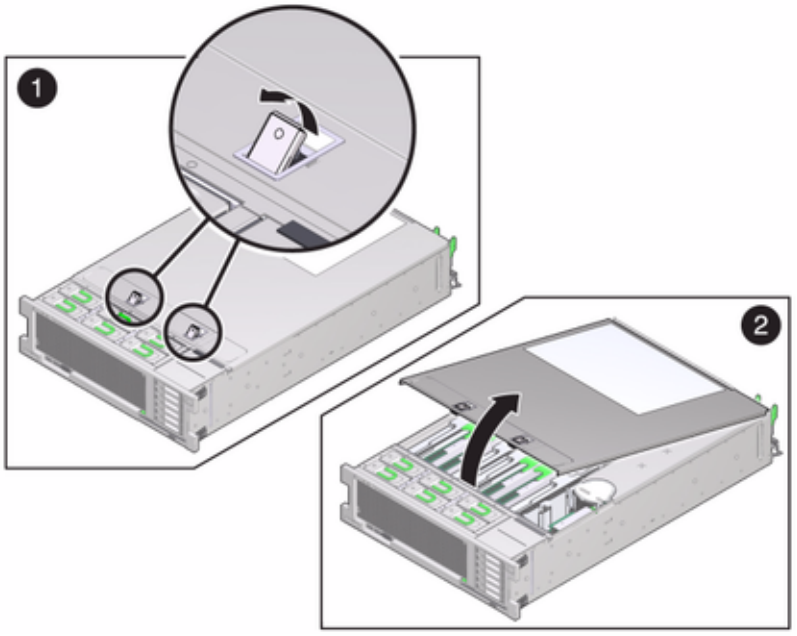
   Unlatch the fan module door, pull the two release tabs back, rotate the fan door to the open position and hold it there.

Press the top cover release button and slide the top cover to the rear about a half-inch (1.3 cm).

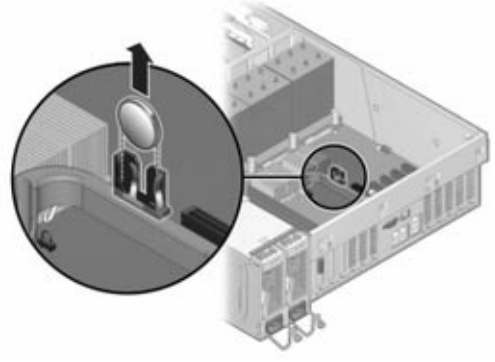
Lift up and remove the top cover.

6. **7420:** To remove the top cover:

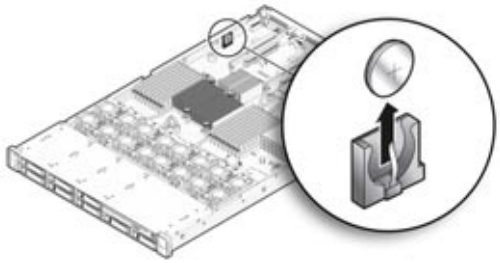
   Simultaneously lift both cover latches in an upward motion.



7. Lift up and remove the top cover.
8. Using a small, non-metallic screwdriver, press the latch and remove the battery from the motherboard. The 7420 battery is shown here.



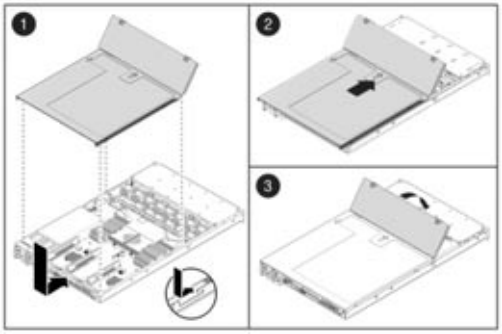
The following figure shows the 7120 battery.



9. Press the replacement battery into the motherboard with the positive side (+) facing upward.
10. **7120 or 7320:** Components may differ slightly between the 7120 and 7320, however service procedures for each are identical. The illustration shows the 7320. To install the top cover:

    Place the top cover on the chassis so that it hangs over the rear of the storage controller by about an inch (2.5 cm), then slide the top cover forward until it seats.

    Close the fan cover and engage the fan cover latches. The cover must be completely closed for the storage controller to power on.

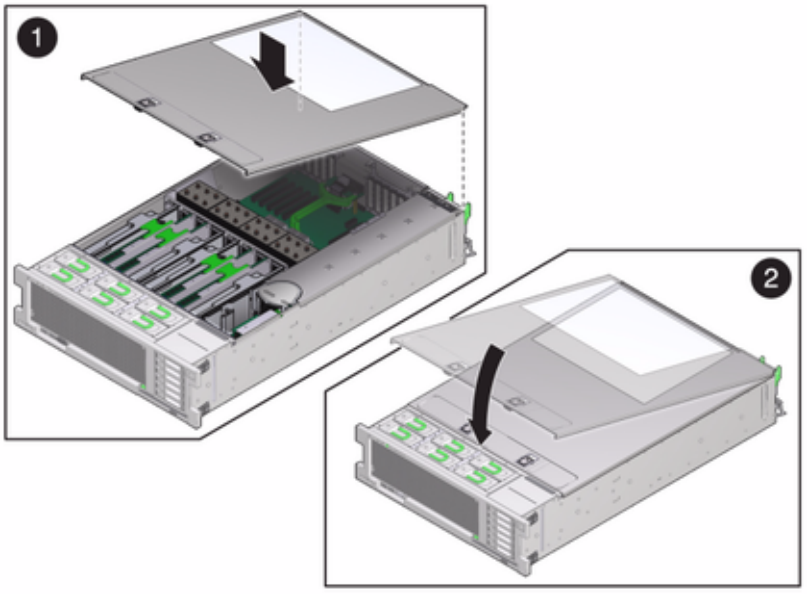


11. **7420:** To install the top cover:

    Place the top cover on the chassis (1) so that it is forward of the rear of the storage controller by about an inch (2.5 cm).

    Slide the top cover toward the rear of the chassis (2) until it seats.

Press down on the cover with both hands until both latches engage.



12. Push the release tabs on the side of each rail and slowly push the storage controller into the rack, making sure no cables obstruct the path of the controller.
13. Connect the power cords to the power supplies.
14. Verify that standby power is on, indicated by the Power/OK status indicator flashing on the front panel about two minutes after the power cords are plugged in.
15. Use a pen, or other pointed object, to press and release the recessed Power button on the storage controller front panel. The Power/OK status indicator next to the Power button lights and remains lit.
16. Connect data cables to the PCIe card, routing them through the cable management arm.
17. When the system has finished booting, log in and set the time using the steps in the BUI Clock task.

Oracle DE2 and Sun Disk Shelf Interoperability

Oracle DE2s and Sun Disk shelves can be used together with standalone and clustered 7x20 controllers after certain hardware modifications. Contact Oracle Service to update your controllers for disk shelf interoperability.

Shelf

Disk Shelf Overview

Oracle disk shelves are high-availability serial attached SCSI (SAS) devices that provide expanded storage. The main components are hot-swappable, including drives, I/O Modules (IOMs) or SAS Interface Module (SIM) boards for connecting to controllers and other disk shelves, and dual load-sharing power supply with fan modules. This provides a fault-tolerant environment with no single point of failure. Component status is indicated with lights on the disk shelf, and in the Maintenance > Hardware screen of the BUI.

Refer to Disk Shelf Tasks for procedural information about replacing disk shelf components.

Oracle Storage Drive Enclosure DE2-24P

The Oracle Storage Drive Enclosure DE2-24P is a 2U chassis that supports 24 2.5" SAS-2 drives. The high-performance HDDs provide reliable storage, and the SSDs provide accelerated write operations. This disk shelf features dual, redundant I/O Modules (IOMs), and dual power supply with fan modules.

Oracle Storage Drive Enclosure DE2-24C

The Oracle Storage Drive Enclosure DE2-24C is a 4U chassis that supports 24 3.5" SAS-2 drives. The SSDs provide accelerated write operations, and the high-capacity HDDs provide reliable storage. This disk shelf features dual, redundant I/O Modules (IOMs), and dual power supply with fan modules.

Sun Disk Shelf 24x3.5" SAS-2

The Sun Disk Shelf is a 4U chassis that supports 24 3.5" SAS-2 drives. The SSDs provide accelerated write operations, and the high-capacity HDDs provide reliable storage. This disk shelf features dual, redundant SAS Interface Module (SIM) boards, and dual power supply with fan modules.

SAS-2

The SAS-2 (Serial Attached SCSI 2.0) storage fabric supports a greater number of targets, greater bandwidth, higher reliability and bigger scale. The scale and reliability improvements are achieved with SAS-2 disks you can daisy-chain to as many as 36 shelves for certain systems, for a total of 864 disks. In addition, the high-performance SAS-2 HBA is designed for the Sun ZFS Storage 7000 series with a standard chip set to support a high-density of target devices, capable of attachment to 1024 targets.

With this fabric, you are encouraged to apply entire shelves to pools, so you can gain the benefits of No Single Point of Failure configurations, and striping across the maximum possible number of devices.

The following shelves implement SAS-2 disks:

- Oracle Storage Drive Enclosure DE2-24P
- Oracle Storage Drive Enclosure DE2-24C
- Sun Disk Shelf

Front Panel

The front panel consists of the drives and indicator lights.

Drive Locations

The following figures show the location of the drives.

Oracle Storage Drive Enclosure DE2-24P

Up to four Logzilla SSDs are supported per disk shelf.

Logzilla SSDs should be populated in order of slots 20, 21, 22, and 23.

Oracle Storage Drive Enclosure DE2-24C and Sun Disk Shelf

Up to four Logzilla SSDs are supported per disk shelf.

Logzilla SSDs should be populated in order of slots 20, 21, 22, and 23. (The Oracle Storage Drive Enclosure DE2-24C is shown and represents both models.)

Front Panel Indicators

The following figures show the front panel indicators.

Oracle Storage Drive Enclosure DE2-24P

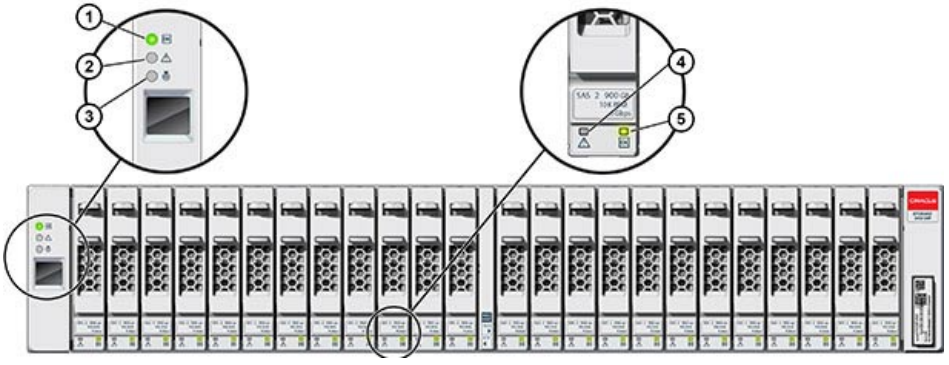


Figure Legend	
1 System power indicator	**4** Drive fault indicator
2 Module fault indicator	**5** Power / Activity indicator
3 Locate indicator	

Oracle Storage Drive Enclosure DE2-24C

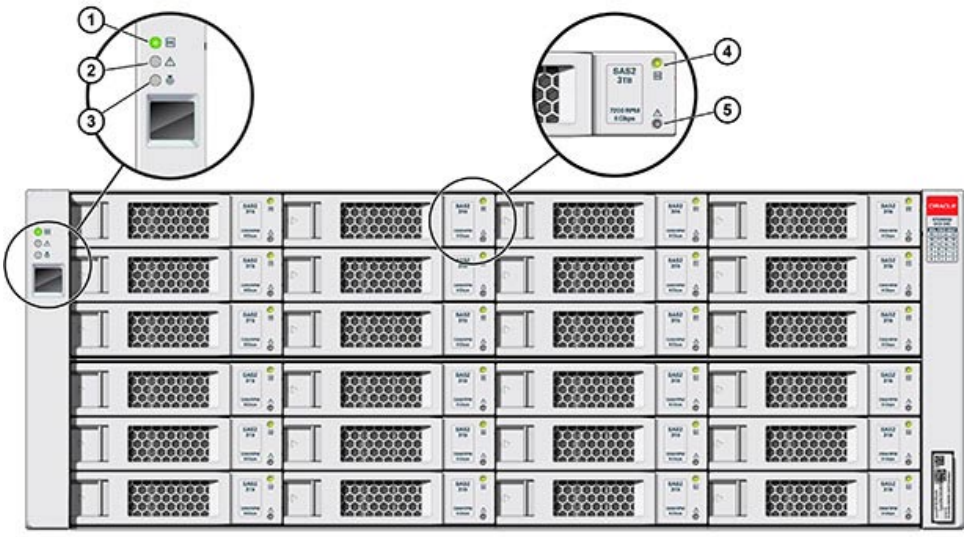


Figure Legend	
1 System power indicator	**4** Power / Activity indicator
2 Module fault indicator	**5** Drive fault indicator
3 Locate indicator	

Sun Disk Shelf

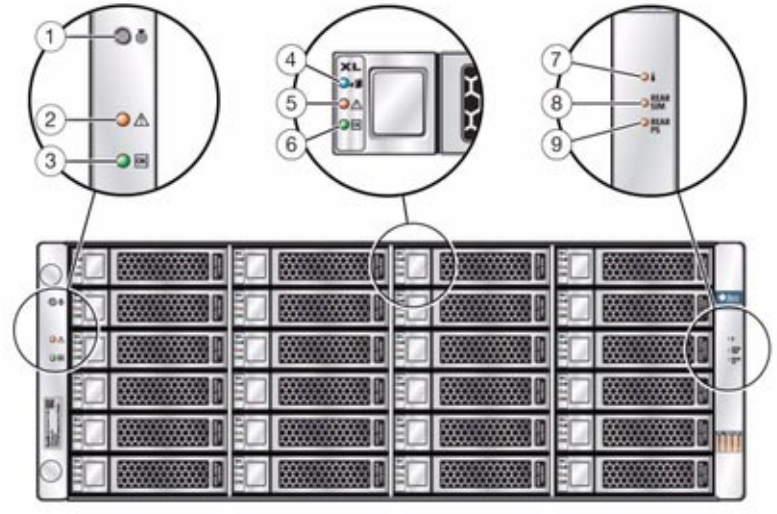


Figure Legend		
1 Locate button and indicator	**4** Disk ready to be removed indicator	**7** Over temperature warning indicator
2 System fault indicator	**5** Disk fault indicator	**8** SIM board fault indicator
3 System power indicator	**6** Disk activity indicator	**9** Power supply fault indicator

Oracle Storage Drive Enclosure DE2-24P

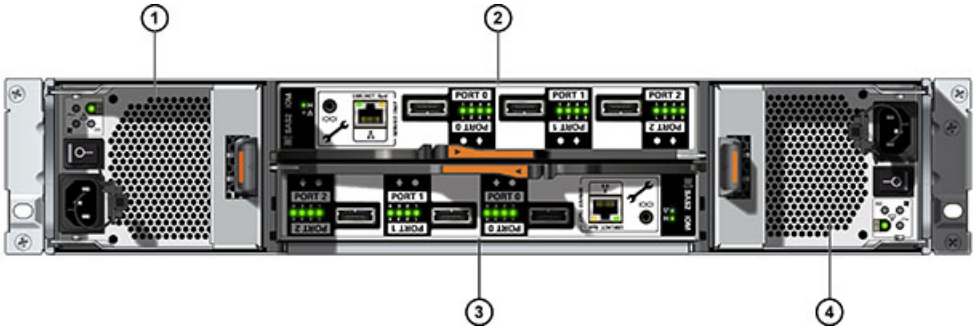


Figure Legend	
1 Power Supply with Fan Module 0	**3** I/O Module 0
2 I/O Module 1	**4** Power Supply with Fan Module 1

Oracle Storage Drive Enclosure DE2-24C

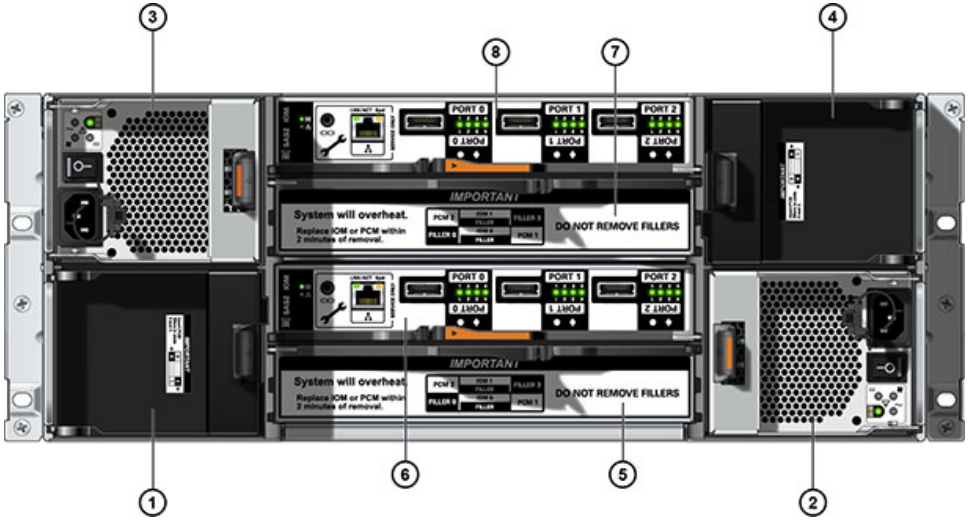


Figure Legend		
1 Power Supply Filler Panel, Slot 0	**4** Power Supply Filler Panel, Slot 3	**7** I/O Module Filler Panel
2 Power Supply with Fan Module 1	**5** I/O Module Filler Panel	**8** I/O Module 1
3 Power Supply with Fan Module 2	**6** I/O Module 0	

Note: It is especially important that power supplies and their filler panels are in the correct slots.

Sun Disk Shelf

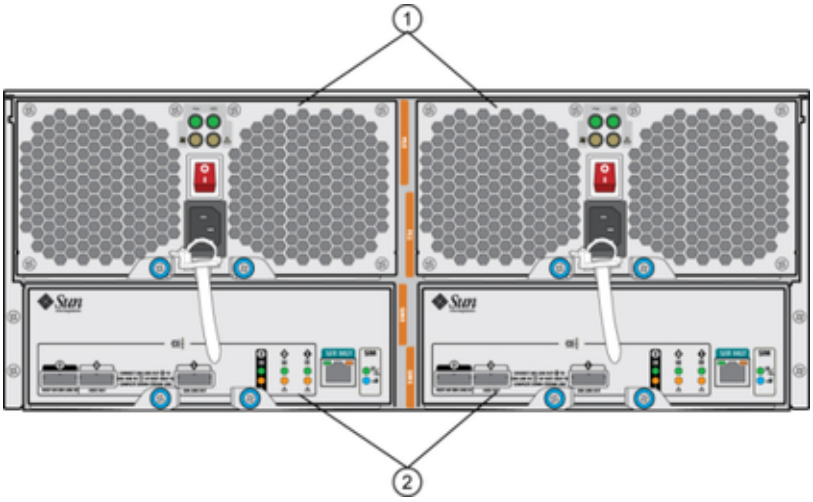


Figure Legend
1 Power supply modules with built-in fans. Power supply 0 is on the left and power supply 1 is on the right.
2 Removable SAS Interface Module (SIM) Boards. SIM 0 is on the left, and SIM 1 is on the right.

I/O Module Indicators

The following disk shelves have I/O Modules (IOMs):

- Oracle Storage Drive Enclosure DE2-24P
- Oracle Storage Drive Enclosure DE2-24C

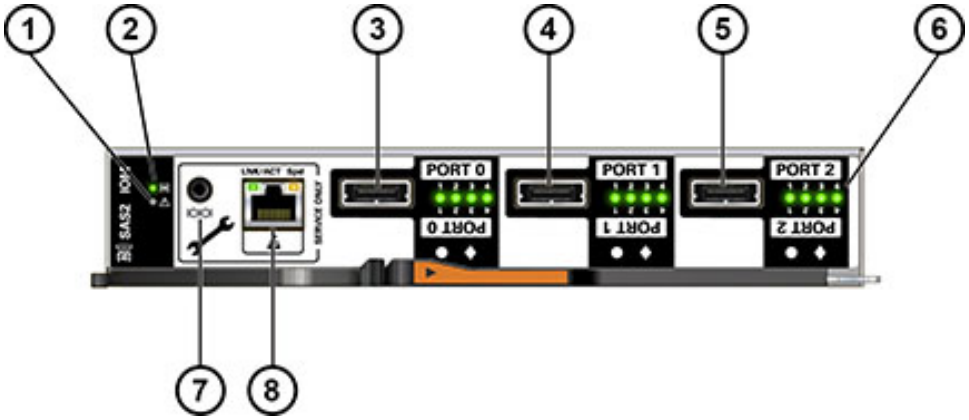


Figure Legend		
1 Fault / Locate indicator	**4** SAS-2 Port 1	**7** For Oracle service only
2 Power / OK indicator	**5** SAS-2 Port 2	**8** For Oracle service only
3 SAS-2 Port 0	**6** Host port activity indicators	

SIM Board Indicators

The following disk shelves have SIM boards:

- Sun Disk Shelf

The following figure shows the SIM board indicators for the Sun Disk Shelf.

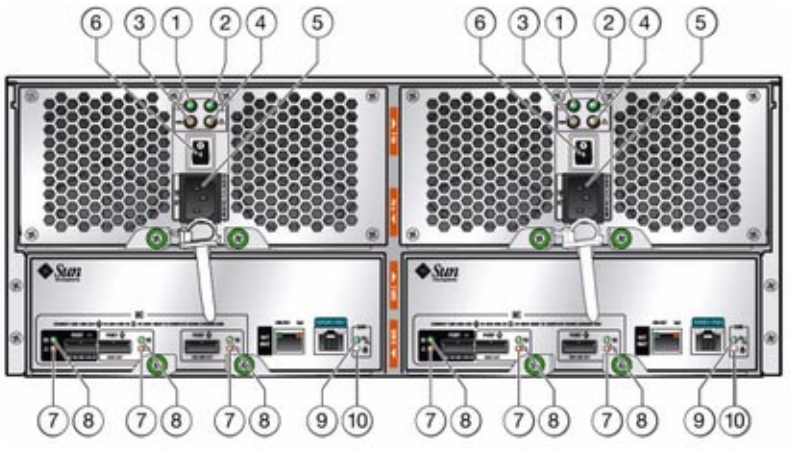


Figure Legend	
1 AC power indicator	**6** Power switch
2 DC power indicator	**7** Port fault indicator
3 Fan fault indicator	**8** Port OK indicator
4 Power supply fault indicator	**9** SIM board OK indicator (green)/SIM board fault indicator (amber)
5 Universal power connector	**10** SIM locator indicator

Power Supply Indicators

The following figure shows power supply with fan module indicators for these disk shelves:

- Oracle Storage Drive Enclosure DE2-24P
- Oracle Storage Drive Enclosure DE2-24C

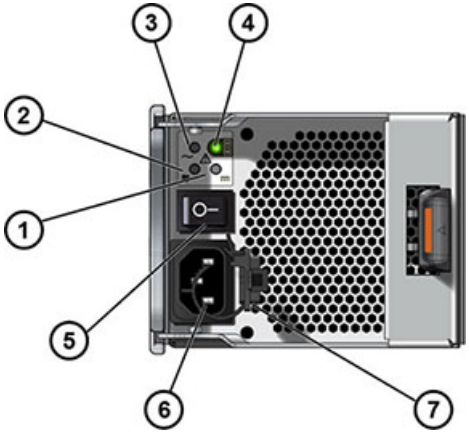


Figure Legend	
1 DC power fail indicator	**6** Universal power input connector
2 Fan fail indicator	**7** Power cord tie wrap
3 AC power fail indicator	
4 Power supply status indicator	
5 Power on/off switch	

The following figure shows power supply with fan module indicators for these disk shelves:

- Sun Disk Shelf

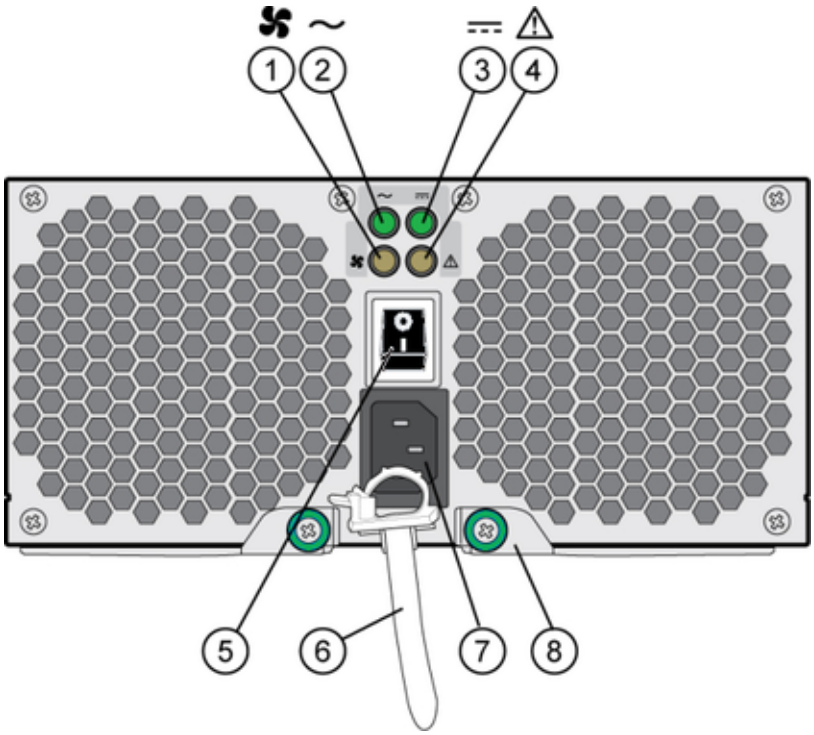


Figure Legend	
1 Cooling fan status indicator	**6** Power cord tie wrap
2 AC power status indicator	**7** Universal power input connector
3 DC power status indicator	**8** Right ejection arm and captive screw latch
4 Power supply status indicator	
5 Power on/off switch	

Disk Shelf Configurations

The following tables describe and provide part numbers for the supported expansion storage shelves.

Oracle Storage Drive Enclosure DE2-24P

Mktg Part Number	Description
7103910	Drive Enclosure DE2-24P Base Chassis

Mktg Part Number	Description
7103911	300GB 10Krpm, SAS-2, 2.5" HDD
7103912	900GB 10Krpm, SAS-2, 2.5" HDD
7103915	73GB SSD SAS-2, 2.5" Write Flash Accelerator
7103917	Filler Panel, Drive Enclosure DE2-24P

Oracle Storage Drive Enclosure DE2-24C

Mktg Part Number	Description
7103914	Drive Enclosure DE2-24C Base Chassis
7103913	3TB 7.2Krpm, SAS-2, 3.5" HDD
7103916	73GB SSD XATO SAS-2, 2.5" (2.5" to 3.5" Drive Adapter)
7103918	Filler Panel, Drive Enclosure DE2-24C

Sun Disk Shelf (DS2)

Mktg Part Number	Description
DS2-0BASE	Sun Disk Shelf (DS2) 24x3.5" SAS-2
DS2-HD2T	2TB 7.2Krpm, SAS-2, 3.5" HDD
7101765	3TB 7.2Krpm, SAS-2, 3.5" HDD
7101274	300GB 15Krpm, SAS-2, 3.5" HDD
7101276	600GB 15Krpm, SAS-2, 3.5" HDD
7101197	73GB SSD XATO, 3.5"
DS2-LOGFILLER	Sun Disk Shelf (DS2) 24x3.5", LOGFiller
DS2-4URK-19U	Disk Shelf Rail Kit

Shelf

Disk Shelf Maintenance Procedures

This section provides procedural details for customer replaceable units (CRUs) of any disk shelf or drive enclosure that attaches to the Oracle ZFS Storage Appliance family of products. Refer to Disk Shelf Overview for component specifications and diagrams.

Prerequisites

Read the information in the overview section for your controller to become familiar with the replaceable parts of the system:

- 7120 | 7320 | 7420 | ZS3-2 | ZS3-4 Overviews - component diagrams and specifications

Follow the instructions in the Electrostatic Discharge Precautions section.

Safety Information

Follow all cautions, warnings, and instructions marked on the equipment and described in Important Safety Information for Oracle's Hardware Systems.

Electrostatic Discharge Precautions

- Remove all plastic, vinyl, and foam material from the work area.
- Wear an antistatic wrist strap at all times when handling any CRU.
- Before handling any CRU, discharge any static electricity by touching a grounded surface.
- Do not remove a CRU from its antistatic protective bag until you are ready to install it.
- After removing a CRU from the chassis, immediately place it in an antistatic bag or antistatic packaging.
- Handle any card that is part of a CRU by its edges only and avoid touching the components or circuitry.
- Do not slide a CRU over any surface.
- Limit body movement (which builds up static electricity) during the removal and replacement of a CRU.

Shelf Electrostatic Discharge Precautions

Removing Power from the Disk Shelf

Most disk shelf components are hot-swappable; you do not need to remove power when replacing them. Do not remove a component if you do not have an immediate replacement. The disk shelf must not be operated without all components in place.

Powering off or removing all SAS chains from a disk shelf will trigger a kernel panic on the controller(s) to prevent data loss, unless the shelf is part of an NSPF (no single point of failure) data pool. To avoid this, shut down the controller(s) before decommissioning the shelf. For details on NSPF profiles, see Profile Configuration.

1. Stop all input and output to and from the disk shelf.
2. Wait approximately two minutes until all disk activity indicators have stopped flashing.
3. Place the power supply on/off switches to the "O" off position.
4. Disconnect the power cords from the external power source for the cabinet.

   Note: All power cords must be disconnected to completely remove power from the disk shelf.

Tasks

Shelf Tasks

▼ Replacing a Drive

The shelf drives are hot-swappable and may be replaced without removing power from the shelf. The replacement drive must be of the same capacity and type as the drive to be replaced. To avoid possible data loss when removing non-faulted drives, label each drive with the number of the slot from which it was removed and reinstall each drive into the same slot.

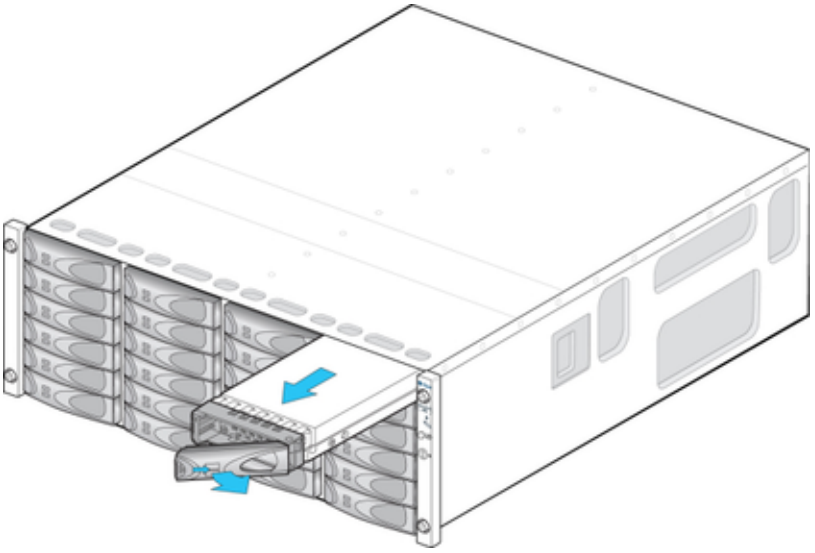
Faulted drives are indicated by an amber LED. Go to the Maintenance > Hardware section of the BUI, click the right-arrow icon at the beginning of the appropriate disk shelf row, and click the information icon for the appropriate drive to view details, or click the locate icon to turn on the locator LED.

Important: Do not remove a component if you do not have an immediate replacement. The disk shelf must not be operated without all components in place.

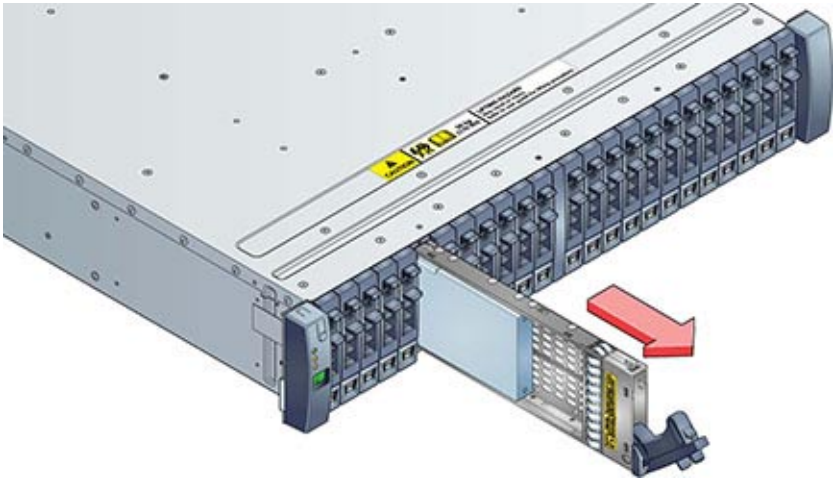
1 Locate the failed disk drive at the front of the chassis.

2 Press the release button or latch to release the drive lever.

3 **Pull the drive lever fully open to unlock and partially eject the drive from the chassis.**



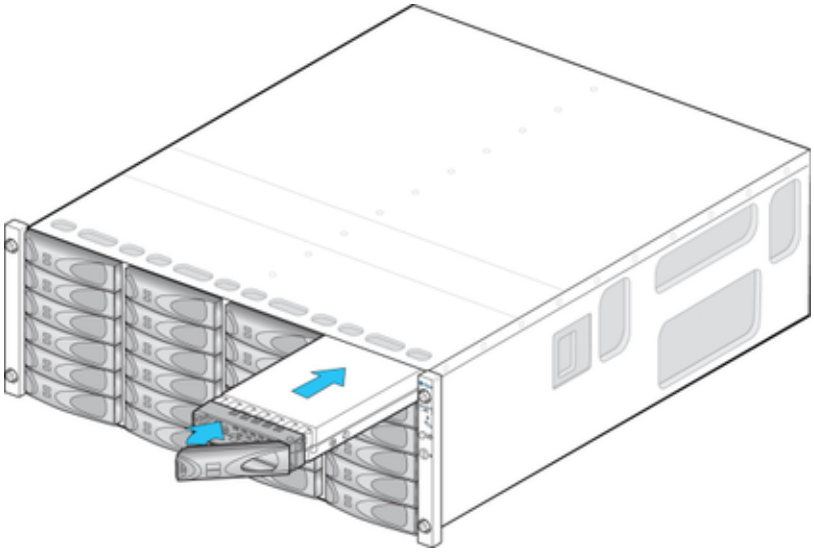
-- OR --



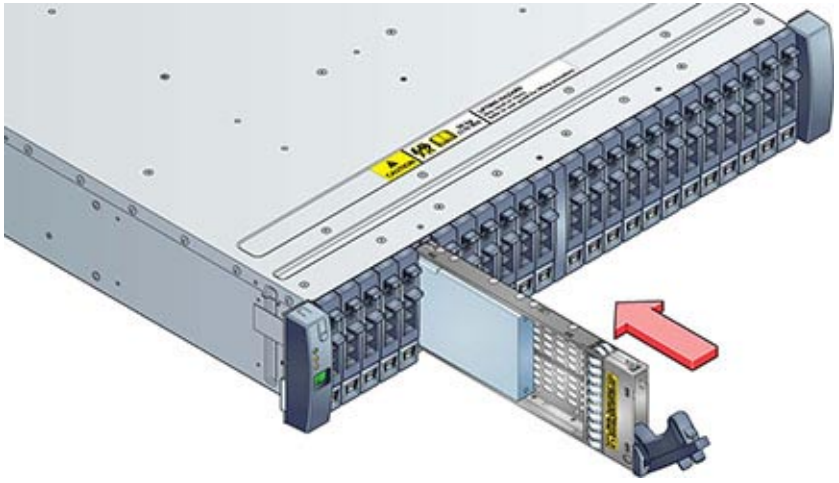
4 **Grasp the middle of the drive body and pull it toward you to remove it from the chassis.**

5 **Ensure the new drive lever is in the fully extended position.**

6 **While constantly pushing toward the pivot point of the lever, slide the drive fully into the chassis slot.**



-- OR --



7 **Press the drive lever closed until it locks in place. For vertically oriented drives, push down on the top of the drive if it is higher than surrounding drives to properly seat it. The Activity LED will be steady green to indicate a ready state.**

8 **Go to the Maintenance > Hardware section of the BUI, click the right-arrow icon at the beginning of the appropriate disk shelf row, and then click Disk to verify that the disk icon is green for the newly installed disk.**

Replacing a Power Supply

Disk shelves are provided with redundant power supplies to prevent loss of service due to component failure. Each power supply is accompanied by one or more chassis cooling fans in one customer-replaceable unit (CRU). Power supplies are hot-swappable, meaning they can be replaced one at a time without removing power from the disk shelf. The modules can produce a high-energy hazard and should only be replaced by instructed individuals with authorized access to the equipment.

Separate indicator LEDs on the rear panel represent the operational state of power supplies and fans individually; see the rear panel illustration for details. Failed components are indicated by amber LEDs as well as amber icons in the administrative BUI. Go to the Maintenance > Hardware section of the BUI, click the right-arrow icon at the beginning of the appropriate disk shelf row, then select PSU or Fan to view details on the respective components. You can also click the locate icon to flash the chassis locator LED.

`Important:` Do not remove a component if you do not have an immediate replacement. The disk shelf must not be operated without all components in place.

1 **Locate the chassis and module containing the failed component.**

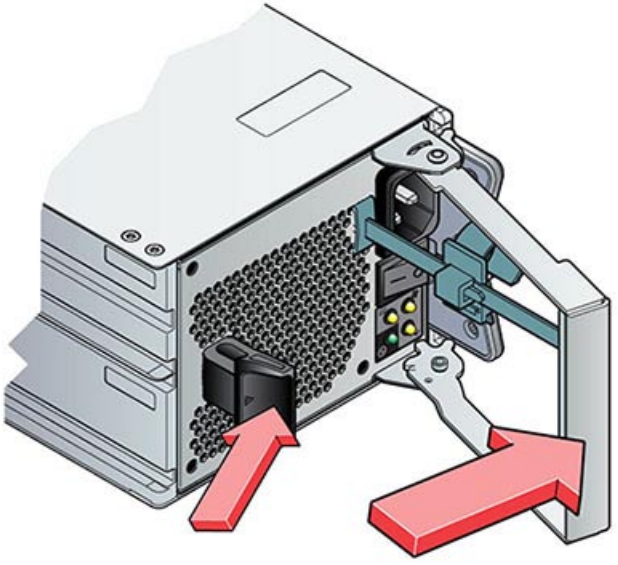
2 **Ensure the power supply on/off switch is in the "O" off position.**

3 **Disconnect the power cord tie strap from the power cord, and unplug the power cord from the power supply.**

4 **Release the lever/ejection arms.**

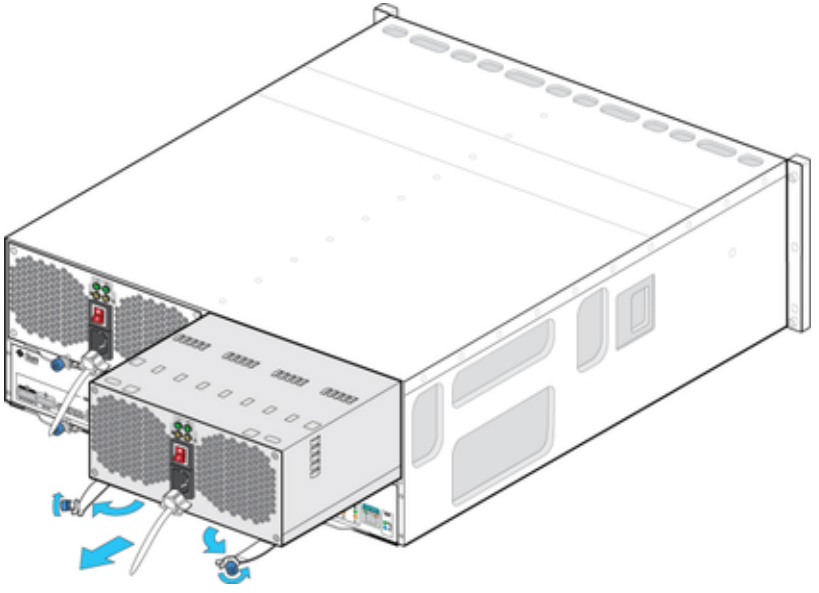
`Oracle Storage Drive Enclosure DE2-24P or DE2-24C:`

Grasp the latch and the opposite side of the module, and squeeze together to release the lever.



Sun Disk Shelf:

Using your thumb and forefinger, unscrew both ejection arm captive screws until loose and swing the ejection arms out until they are fully open.



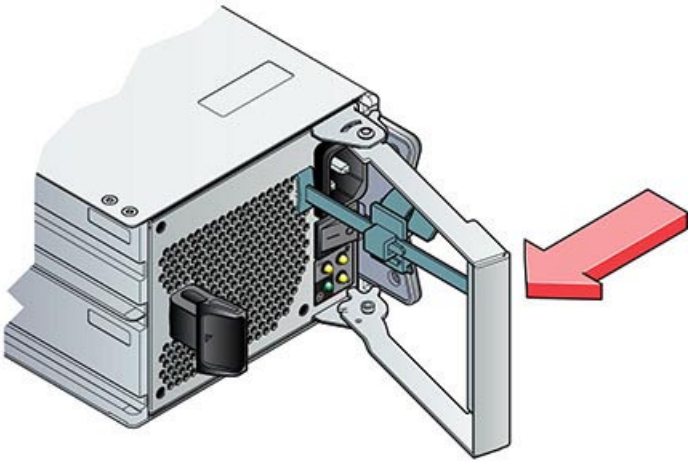
5 Pull the module out of the chassis, being careful not to damage the connector pins in the back.

6 **With the lever/ejection arms fully open, slide the new module into the chassis slot until it contacts the chassis backplane, and the lever/ejection arms begin to engage.**

7 **Close the lever/ejection arms.**

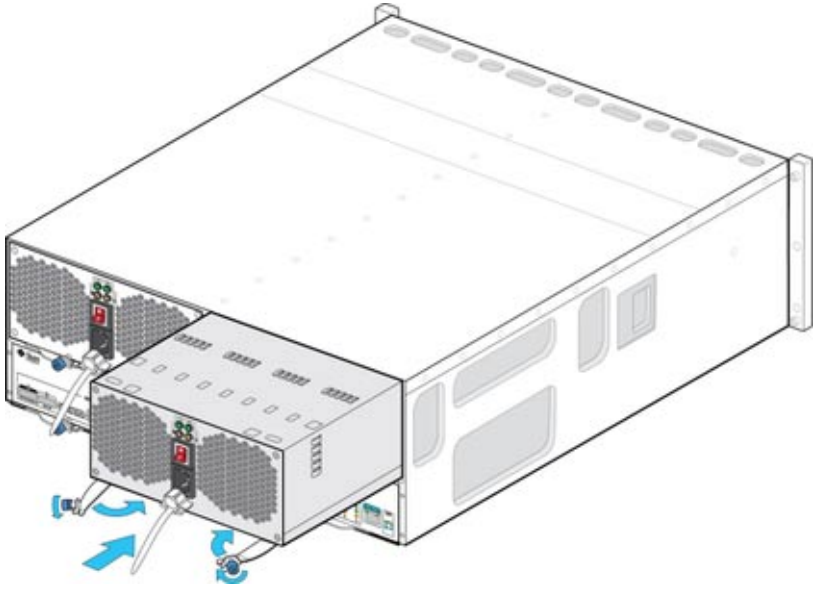
`Oracle Storage Drive Enclosure DE2-24P or DE2-24C:`

Push the lever fully closed until you hear or feel a click.



`Sun Disk Shelf:`

Push the ejection arms fully closed and secure both captive screws to seat and secure the module in the chassis.



8. **Ensure the power supply on/off switch is in the "O" off position.**
9. **Plug the power cord into the new power supply and attach the power cord tie strap to the power cord.**
10. **Place the power supply on/off switch to the "I" on position. The Power/OK status LED should be a steady green, and all other indicators should be off.**
11. **Go to the Maintenance > Hardware section of the BUI, and click the right-arrow icon at the beginning of the appropriate disk shelf row. As appropriate for the failure, click either PSU or Fan to verify that the icon is green for the newly installed power supply with fan module.**

Replacing an I/O Module

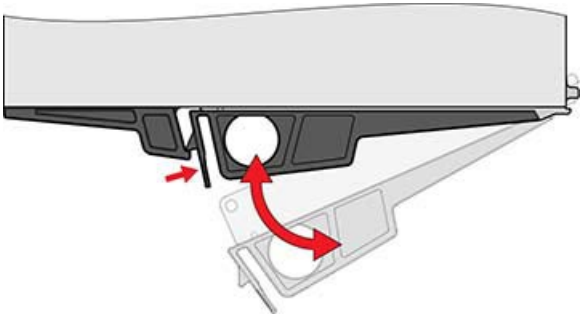
The following disk shelves have I/O Modules (IOMs):

- Oracle Storage Drive Enclosure DE2-24P
- Oracle Storage Drive Enclosure DE2-24C

The I/O Modules (IOMs), which are similar to SIM boards, are hot-swappable so you can replace them without removing power to the system. A faulted I/O Module is indicated by an amber LED. Go to the Maintenance > Hardware section of the BUI, click the right-arrow icon at the beginning of the appropriate disk shelf row, and then click Slot to view details, or click the locate icon to turn on the locator LED.

`Important:` Do not remove a component if you do not have an immediate replacement. The disk shelf must not be operated without all components in place.

1. **Locate the failed I/O Module at the back of the disk shelf.**
2. **Label and disconnect the I/O Module interface cables.**
3. **Using your thumb and forefinger, squeeze the release button toward the lever hole to release**



the lever.

4 **Grasp the lever and remove the I/O Module, being careful not to damage the connector pins in back.**

5 **With the lever of the new I/O Module in the open position, slide the I/O Module into the disk shelf, being careful of the connector pins.**

6 **Push the lever fully closed until you hear or feel a click.**

7 **Reconnect the interface cables to their original locations.**

8 **Wait approximately 60 seconds for the I/O Module to complete its boot process, at which time the Power LED should be solid green and the Fault/Locate LED should be off. All four activity LEDs should be solid green for each SAS-2 port that has an interface cable connected to it.**

9 **Go to the Maintenance > Hardware section of the BUI, click the right-arrow icon at the beginning of the appropriate disk shelf row, and then click Slot to verify that the I/O Module icon is green for the newly installed I/O Module.**

Replacing a SIM Board

The following disk shelves have SIM boards:

- Sun Disk Shelf

The SIM boards, which are similar to I/O Modules, are hot-swappable so you can replace them without removing power to the system. The SIM boards are multi-pathed, so you can remove one of the SIM boards at any time, regardless of the state of the blue SIM OK indicator. A faulted SIM board is indicated by an amber LED. Go to the Maintenance > Hardware section of the BUI, click the right-arrow icon at the beginning of the appropriate disk shelf row, and then click Slot to view details, or click the locate icon to turn on the locator LED.

`Important:` Do not remove a component if you do not have an immediate replacement. The disk shelf must not be operated without all components in place.

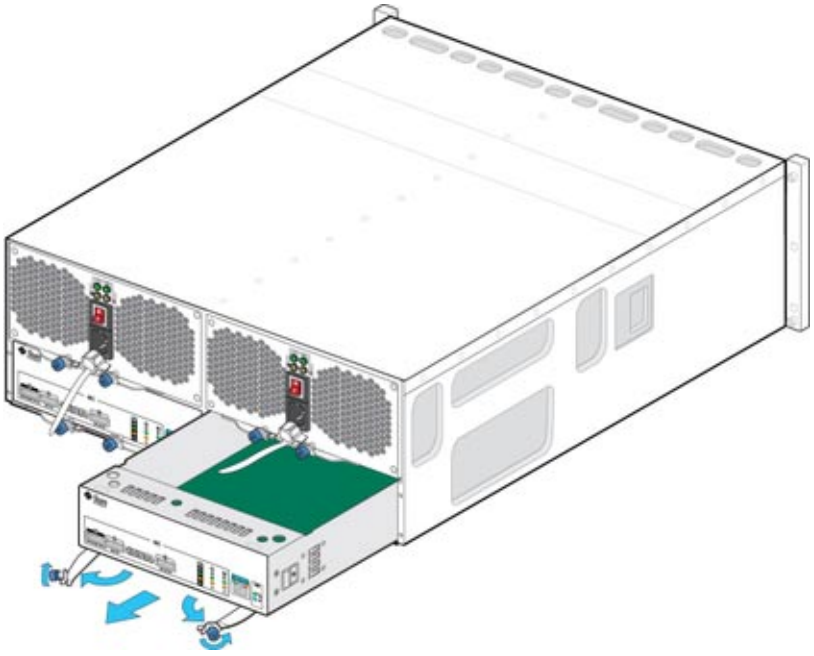
1 **Locate the failed SIM at the back of the disk tray.**

2 **Label and disconnect the tray interface cables.**

3 **Use two hands to disconnect the SAS cable. Grasp the metal body of the connector with one hand and firmly grasp and pull the tab gently toward the connector body with the other, then pull the connector body outward to extract it from the bulkhead. Do not twist or pull the tab in any direction other than parallel with the connector body or it may break. If the tab breaks, use a small sharp object (such as a fine-tipped screwdriver) to lift the metal spring at the top of the connector shell to unlatch it.**

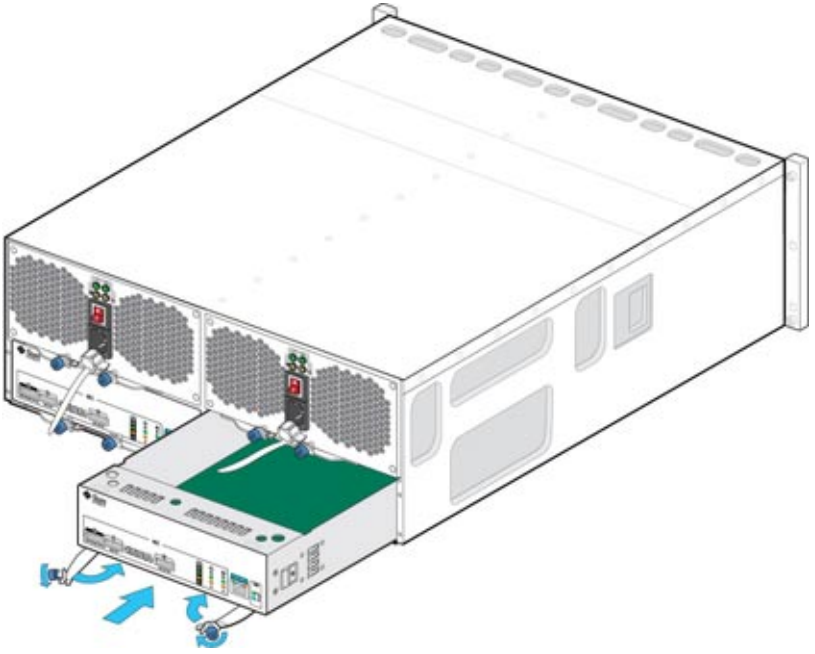
4 **Loosen the two extraction arm captive screws using your thumb and forefinger. If the captive screws are too tight to loosen by hand, use a No.2 Phillips screwdriver to loosen each screw.**

5 **Pull each ejector tab outward and push to the sides to release and partially eject the SIM from the chassis.**



6 **Grasp the middle of the SIM board and slide it out of the slot.**

7 **With the ejector arms in the full open position, align the new SIM board with the open slot and slide it into the tray until the ejector arms contact the tray connectors and begin to swing**



closed.

8 **Swing both ejector arms in until they are flush with the SIM board panel to seat the board.**

9 **Tighten both captive screws to secure the board.**

10 **Reconnect the SAS interface cables to their original locations.**

11 **Wait approximately 60 seconds for the SIM board to complete its boot process, at which time the Power LED should be solid green and the SIM locate LED should be off.**

12 **Go to the Maintenance > Hardware section of the BUI, click the right-arrow icon at the beginning of the appropriate disk shelf row, and then click Slot to verify that the SIM board icon is green for the newly installed SIM board.**

Faults

Hardware Faults

This section describes connecting to the controller Service Processor (SP) and configuration considerations for maximum serviceability. In rare cases, faults associated with uncorrectable CPU errors are not diagnosable or displayed in the controller. These faults will be preserved by and observable on the ILOM. The following sections describe how to connect to and manage faults for these cases.

Connect to ILOM

Connect to the server ILOM (Service Processor) on the server platform to diagnose hardware faults that do not appear in the BUI.

In a cluster environment, an ILOM connection should be made to each controller.

The server ILOM provides options for (i) network and (ii) serial port connectivity. Network connection is the preferred choice, as the ILOM serial port does not always allow adequate means of platform data collection.

WARNING : Failure to configure ILOM connectivity may lead to longer than necessary hardware fault diagnosis and resolution times.

Management Port Configuration

All standalone controllers should have at least one NIC port configured as a management interface. Select the Allow Admin option in the BUI to enable BUI connections on port 215 and CLI connections on `ssh` port 22.

All cluster installations should have at least one NIC port on each controller configured as a management interface as described above. In addition, the NIC instance number must be unique on each controller. For example, nodeA uses igb0 and nodeB uses igb1, so that neither may be used as a cluster data interface. In addition, these interfaces must be locked to the controller using the Configuration -> Cluster option in the BUI. In some cases, this may require installation of an additional network interface card on each controller in a cluster configuration.

If access to the appliance data interfaces is impossible for any reason, the management network interface will maintain BUI and CLI access. During a cluster takeover, interfaces are taken down on the failed controller. So, locked interface configuration is required to gather diagnostic information from a failed controller.

WARNING : Failure to configure locked management interfaces on a cluster may lead to longer than necessary fault diagnosis and resolution times.

Observing and Clearing CPU faults from ILOM

Log in to the server as root using the ILOM CLI. To view server faults, type the following command to list all known faults on the system:

```
-> show /SP/faultmgmt
```

The server lists all known faults, for example:

```
SP/faultmgmt
  Targets:
      0 (/SYS/MB/P0)
  Properties:
  Commands:
      cd
      show
```

To clear the CPU fault, type the following command:

```
-> set /SYS/MB/Pn clear_fault_action=true
```

For example, to clear a fault on CP0:

```
-> set /SYS/MB/P0 clear_fault_action=true
Are you sure you want to clear /SYS/MB/P0 (y/n)? y
```

See Also

Cluster Configuration

Cabling

Connecting to Attached Storage

The cabling information in this section shows a subset of the supported configurations for Oracle ZFS Storage controllers. For the maximum number of disk shelves per controller, see the Summary of Controller Configurations

To cable the controller to the disk shelves, use the following guidelines:

- Connect each disk chain to two HBAs if available.

- Maximize the number of disk chains before adding disk shelves to an individual chain.
- Balance the number of disk shelves across the disk chains in your system.
- Disks with different capacities or rotation speeds cannot be mixed within a single disk shelf.
- To use mixed disk shelf types, the controller must have only 4X4 port SAS-2 HBAs.
- Do not use mixed disk shelves in the same chain, each must be on their own SAS fabric.

The following list provides links to cable diagrams for standalone and clustered controllers.

- Oracle DE2-24 Disk Shelf
- Connecting DE2 Disk Shelves to the ZS3-2/7120/7320 | ZS3-2/7320 Clustered
- Connecting DE2 Disk Shelves to the ZS3-4/7420 | ZS3-4/7420 Clustered
- Sun Disk Shelf
- Connecting Sun Disk Shelves to the 7120/7320 | 7320 Clustered
- Connecting Sun Disk Shelves to the 7420 | 7420 Clustered
- Mixed DE2-24 and Sun Disk Shelves
- Connecting mixed DE2-24 and Sun Disk Shelves to the ZS3-2/7120/7320 | ZS3-2/7320 Clustered
- Connecting mixed DE2-24 and Sun Disk Shelves to the ZS3-4/7420 | ZS3-4/7420 Clustered

Next Steps

After connecting attached storage, apply power and configure the appliance.

- Powering on
- Initial configuration

Storage expansion may require adding or replacing HBAs in your configuration. For information, see the following sections:

- ZS3-2 Maintenance Procedures: PCIe Cards
- ZS3-4 Maintenance Procedures: PCIe Cards and Risers
- 7x20 Maintenance Procedures: PCIe Cards and Risers

Cabling

Connecting to Attached Storage

The cabling information in this section shows a subset of the supported configurations for Oracle ZFS Storage controllers. For the maximum number of disk shelves per controller, see the Summary of Controller Configurations

To cable the controller to the disk shelves, use the following guidelines:

- Connect each disk chain to two HBAs if available.
- Maximize the number of disk chains before adding disk shelves to an individual chain.
- Balance the number of disk shelves across the disk chains in your system.
- Disks with different capacities or rotation speeds cannot be mixed within a single disk shelf.
- To use mixed disk shelf types, the controller must have only 4X4 port SAS-2 HBAs.
- Do not use mixed disk shelves in the same chain, each must be on their own SAS fabric.

The following list provides links to cable diagrams for standalone and clustered controllers.

- Oracle DE2-24 Disk Shelf
- Connecting DE2 Disk Shelves to the ZS3-2/7120/7320 | ZS3-2/7320 Clustered
- Connecting DE2 Disk Shelves to the ZS3-4/7420 | ZS3-4/7420 Clustered
- Sun Disk Shelf
- Connecting Sun Disk Shelves to the 7120/7320 | 7320 Clustered
- Connecting Sun Disk Shelves to the 7420 | 7420 Clustered
- Mixed DE2-24 and Sun Disk Shelves
- Connecting mixed DE2-24 and Sun Disk Shelves to the ZS3-2/7120/7320 | ZS3-2/7320 Clustered
- Connecting mixed DE2-24 and Sun Disk Shelves to the ZS3-4/7420 | ZS3-4/7420 Clustered

Next Steps

After connecting attached storage, apply power and configure the appliance.

- Powering on
- Initial configuration

Storage expansion may require adding or replacing HBAs in your configuration. For information, see the following sections:

- ZS3-2 Maintenance Procedures: PCIe Cards
- ZS3-4 Maintenance Procedures: PCIe Cards and Risers
- 7x20 Maintenance Procedures: PCIe Cards and Risers

Summary of Controller Configurations

Maximum Controller Configurations

The following table shows the maximum supported controller configurations.

NOTE: Controllers cannot use 2X4 port SAS-2 HBAs and 4X4 port SAS-2 HBAs at the same time. To use DE2 and Sun Disk Shelves together, the controller must use 4X4 port SAS-2 HBAs, which are only supported with release AK 2013.1.0 and later.

Controller	Max. Shelves	Max. 2X4 port SAS-2 HBA	Max. 4X4 port SAS-2 HBA
ZS3-2	8	NA	2
ZS3-4	36	NA	4
7120	2	1	NA
7320	6	1	1
7420	36	6	6

DE2 to ZS3-2/7120/7320 Standalone

Connecting ZS3-2/7120/7320 Standalone Controllers to Disk Shelves

The following figures show a subset of the supported configurations for Oracle ZFS Storage ZS3-2/7120/7320 standalone controllers with one or two HBAs.

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model.

Cable Diagrams

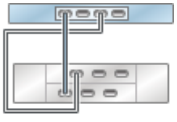


fig.1 Standalone controller with one HBA and one disk shelf in a single chain.

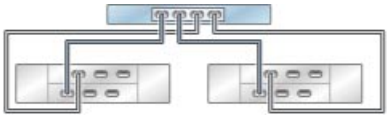


fig.2 One HBA and two disk shelves in two chains.

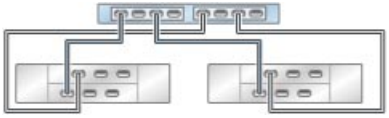


fig.3 Two HBAs and two disk shelves in two chains.

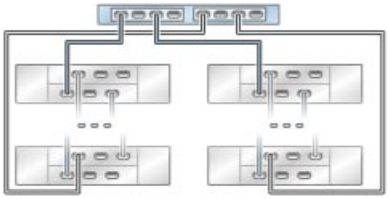


fig.4 Two HBAs and multiple disk shelves in two chains.

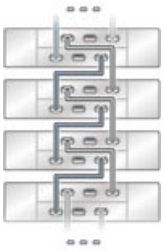


fig.5 Four disk shelves in a single chain.

DE2 to ZS3-2/7320 Clustered

Connecting ZS3-2/7320 Clustered Controllers to Disk Shelves

The following figures show a subset of the supported configurations for Oracle ZFS Storage ZS3-2/7320 clustered controllers with one HBA.

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model.

Cable Diagrams

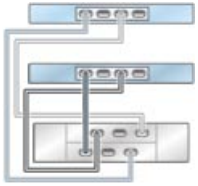


fig.1 Clustered controllers with one HBA and one disk shelf in a single chain.

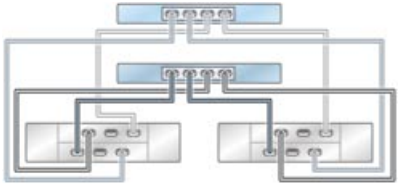


fig.2 One HBA and two disk shelves in two chains.

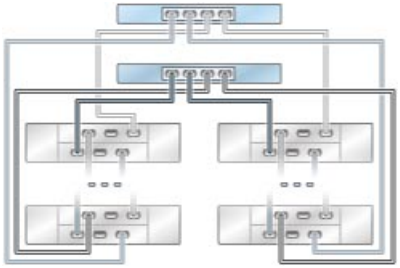


fig.3 One HBA and multiple disk shelves in two chains.

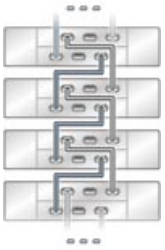


fig.4 Four disk shelves in a single chain.

DE2 to ZS3-4/7420 Standalone

Connecting the ZS3-4/7420 Standalone Controller to Disk Shelves (3 HBAs)

The following figures show a subset of the supported configurations for Oracle ZFS Storage ZS3-4/7420 standalone controllers with three HBAs.

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model.

Cable Diagrams

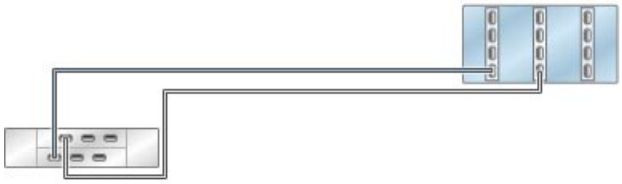


fig.1 Standalone controller with three HBAs and one disk shelf in a single chain.

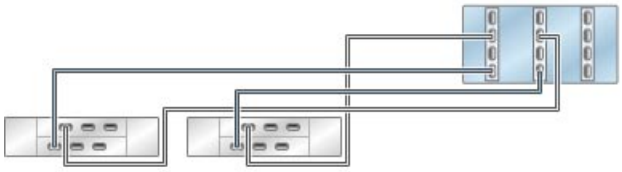


fig.2 Three HBAs and two disk shelves in two chains.

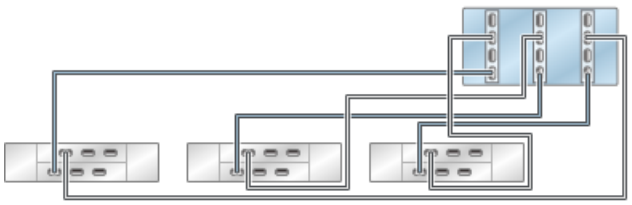


fig.3 Three HBAs and three disk shelves in three chains.

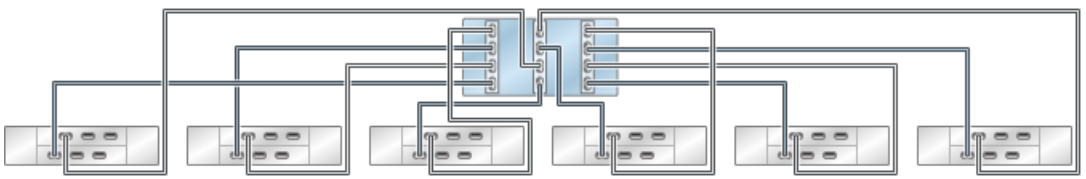


fig.4 Three HBAs and six disk shelves in six chains.

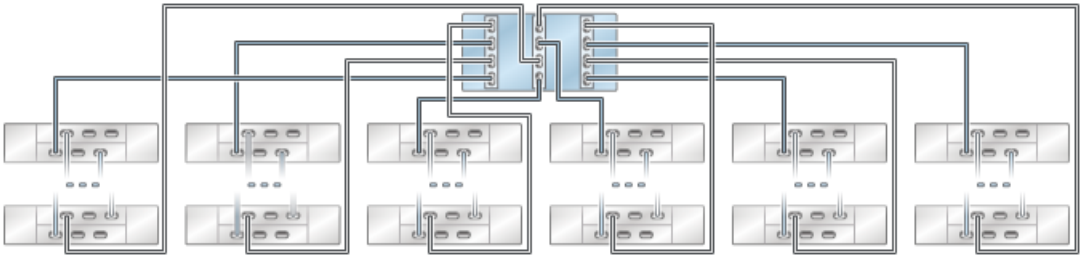


fig.5 Three HBAs with multiple disk shelves in six chains.

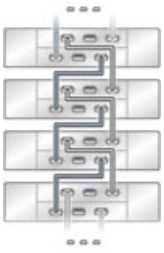


fig.6 Four disk shelves in a single chain.

DE2 to ZS3-4/7420 Clustered

Connecting the ZS3-4/7420 Clustered Controller to Disk Shelves (3 HBAs)

The following figures show a subset of the supported configurations for Oracle ZFS Storage ZS3-4/7420 clustered controllers with three HBAs.

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model.

Cable Diagrams

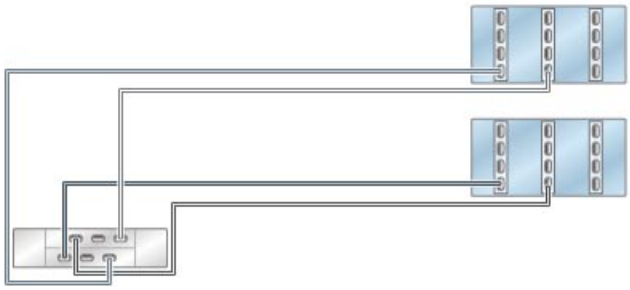


fig.1 Clustered controllers with three HBAs and one disk shelf in a single chain.

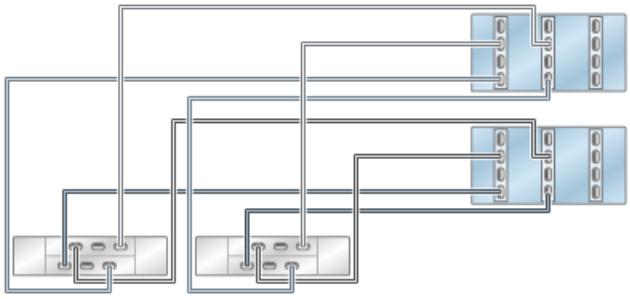


fig.2 Three HBAs and two disk shelves in two chains.

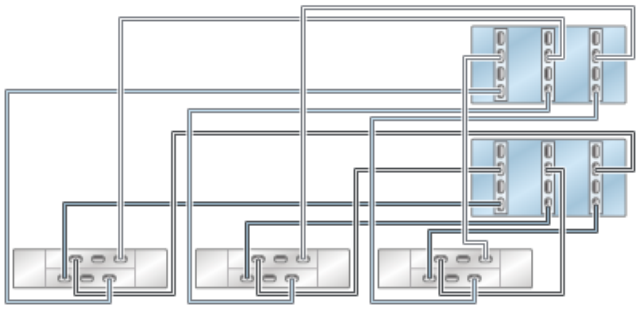


fig.3 Three HBAs and three disk shelves in three chains.

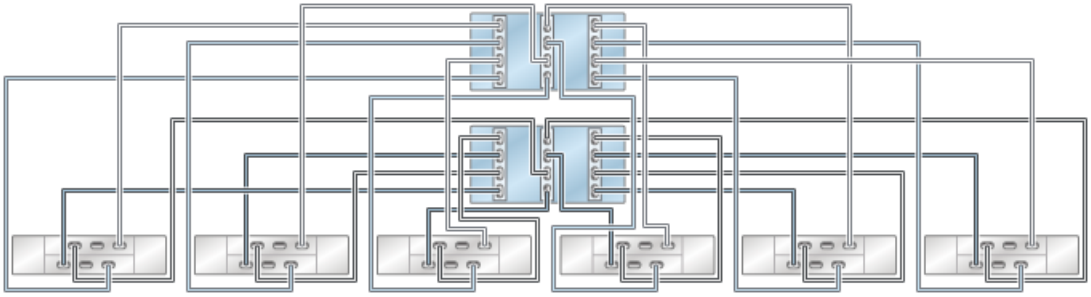


fig.4 Three HBAs and six disk shelves in six chains.

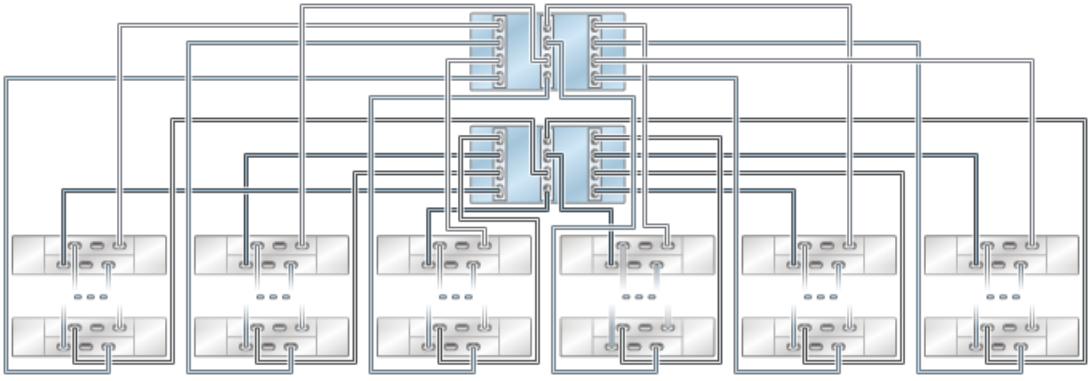


fig.5 Three HBAs and multiple disk shelves in six chains.

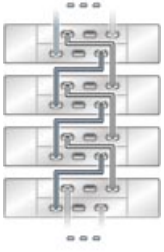


fig.6 Four disk shelves in a single chain.

7120-7320 Cabling

Connecting 7120/7320 Standalone Controllers to Sun Disk Shelves

The following figures show a subset of the supported configurations for Oracle ZFS Storage 7120/7320 standalone controllers with one HBA.

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model.

Cable Diagrams

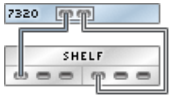


fig.1 Standalone controller with one HBA and one disk shelf in a single chain.

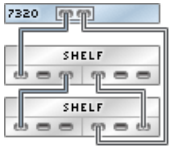


fig.2 One HBA and two disk shelves in a single chain.

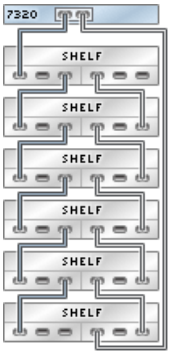


fig.3 One HBA and six disk shelves in a single chain.

7320 Cluster Cabling

Connecting the 7320 Clustered Controller to Sun Disk Shelves

The following figures show a subset of the supported configurations for Oracle ZFS Storage 7320 clustered controllers with one HBA.

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model.

Cable Diagrams

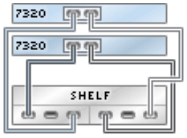


fig.1 Clustered controllers with one HBA and one disk shelf in a single chain.

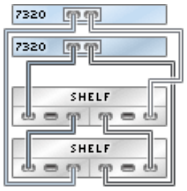


fig.2 One HBA and two disk shelves in a single chain.

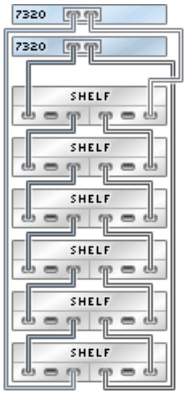


fig.3 One HBA and six disk shelves in a single chain.

7420 Cabling

Connecting the 7420 Standalone Controller to Sun Disk Shelves (2 and 6 HBAs)

The following figures show a subset of the supported configurations for Oracle ZFS Storage 7420 standalone controllers with two and six HBAs.

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model.

Cable Diagrams

fig.1 Standalone controller with two HBAs and one disk shelf in a single chain.

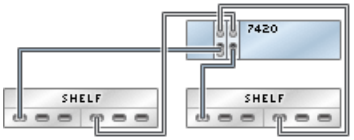


fig.2 Two HBAs and two disk shelves in two chains.

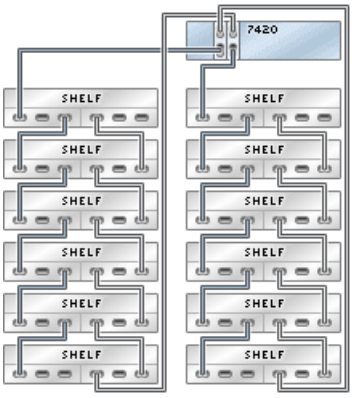


fig.3 Two HBAs and 12 disk shelves in two chains.

fig.4 Standalone controller with six HBAs and one disk shelf in a single chain.

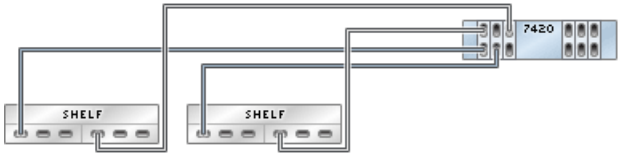


fig.5 Six HBAs and two disk shelves in two chains.

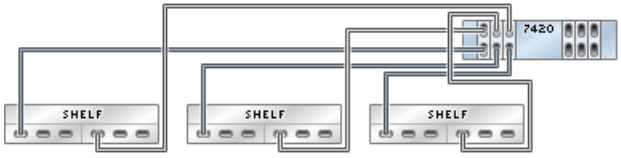


fig.6 Six HBAs and three disk shelves in three chains.

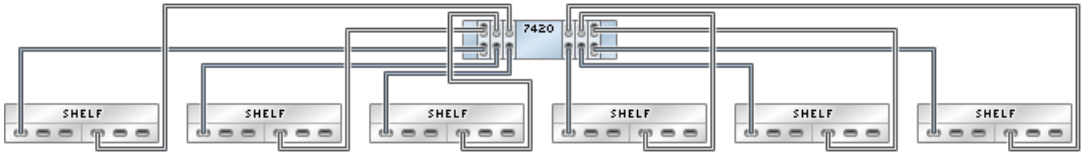


fig.7 Six HBAs and six disk shelves in six chains.

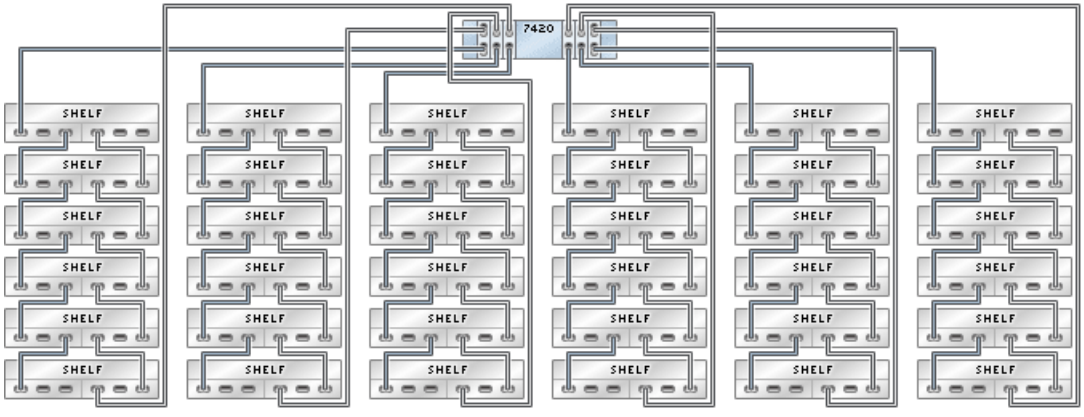


fig.8 Six HBAs and 36 disk shelves in six chains.

7420 Cluster Cabling

Connecting the 7420 Clustered Controllers to Disk Shelves (2 and 6 HBAs)

The following figures show a subset of the supported configurations for Oracle ZFS Storage 7420 clustered controllers with two and six HBAs.

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model.

Cable Diagrams

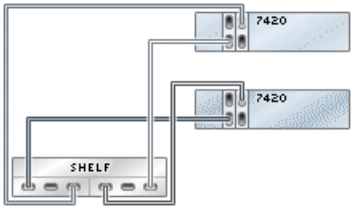


fig.1 Clustered controllers with two HBAs and one disk shelf in a single chain.

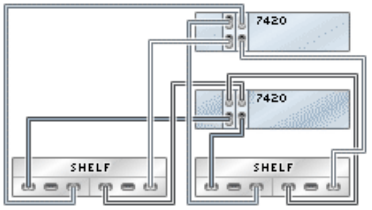


fig.2 Two HBAs and two disk shelves in two chains.

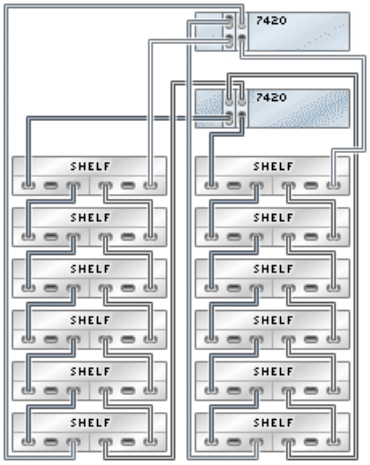


fig.3 Two HBAs and 12 disk shelves in two chains.

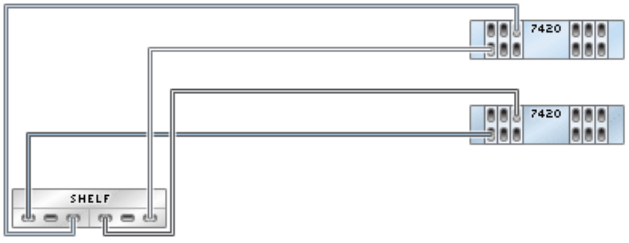


fig.4 Clustered controllers with six HBAs and one disk shelf in a single chain.

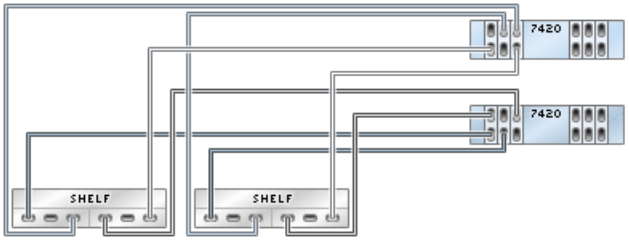


fig.5 Six HBAs and two disk shelves in two chains.

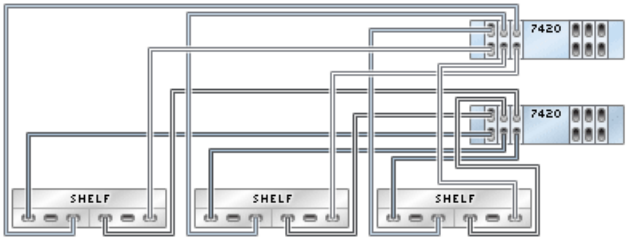


fig.6 Six HBAs and three disk shelves in three chains.

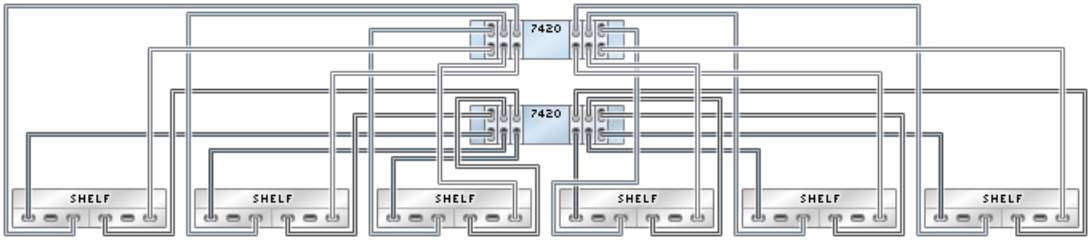


fig.7 Six HBAs and six disk shelves in six chains.

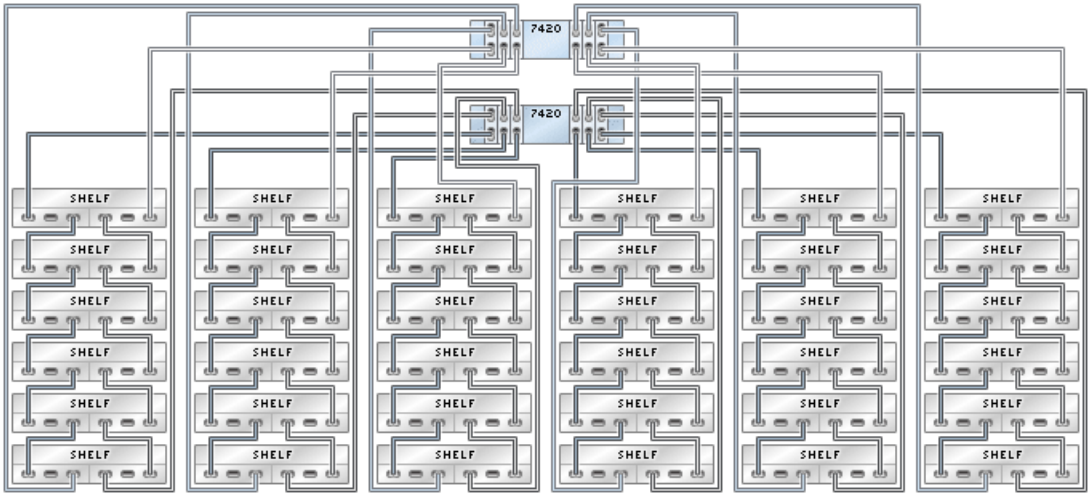


fig.8 Six HBAs and 36 disk shelves in six chains.

ZS3-2/7120/7320 with DE2 and Sun Disk Shelves

Connecting ZS3-2/7120/7320 Standalone Controllers to Mixed Disk Shelves

The following figures show a subset of the supported configurations for Oracle ZFS Storage ZS3-2/7120/7320 standalone controllers with one HBA. Using mixed disk shelves on a controller requires the following:

- The controller must use only 4X4 port SAS-2 HBAs
- Do not use mixed disk shelves in the same chain

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model. 4X4 port SAS-2 HBAs are only supported with release AK 2013.1.0 and later.

Cable Diagrams

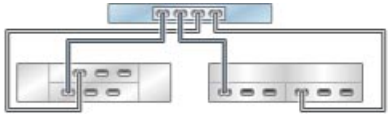


fig.1 Standalone controller with one HBA and two disk shelves in two chains (DE2-24 on the left).

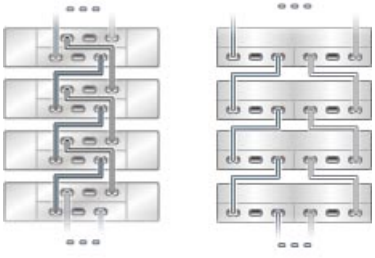


fig.2 Eight disk shelves in two chains (DE2-24 on the left).

ZS3-2/7320 Clustered with DE2 and Sun Disk Shelves

Connecting ZS3-2/7320 Storage Clustered Controllers to Mixed Disk Shelves

The following figures show a subset of the supported configurations for Oracle ZFS Storage ZS3-2/7320 clustered controllers with one HBA. Using mixed disk shelves on a controller, requires the following:

- The controller must use only 4X4 port SAS-2 HBAs
- Do not use mixed disk shelves in the same chain

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model. 4X4 port SAS-2 HBAs are only supported with release AK 2013.1.0 and later.

Cable Diagrams

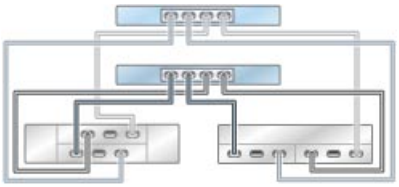


fig.1 Clustered controllers with one HBA and two disk shelves in two chains (DE2-24 on the left).

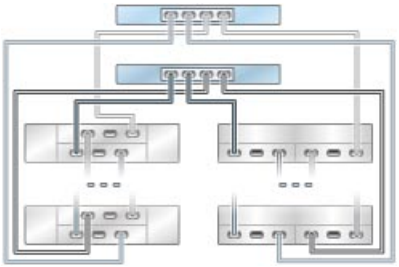


fig.2 One HBA and multiple disk shelves in two chains (DE2-24 on the left).

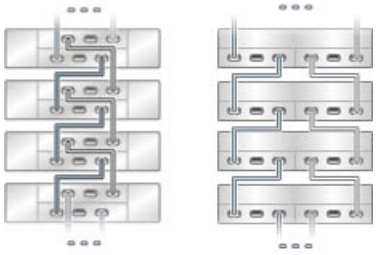


fig.3 Eight disk shelves in two chains (DE2-24 on the left).

ZS3-4/7420 with DE2 and Sun Disk Shelves

Connecting ZS3-4/7420 Standalone Controllers to Mixed Disk Shelves

The following figures show a subset of the supported configurations for Oracle ZFS Storage ZS3-4/7420 standalone controllers with two HBAs. Using mixed disk shelves on a controller, requires the following:

- The controller must use only 4X4 port SAS-2 HBAs
- Do not use mixed disk shelves in the same chain

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model. 4X4 port SAS-2 HBAs are only supported with release AK 2013.1.0 and later.

Cable Diagrams

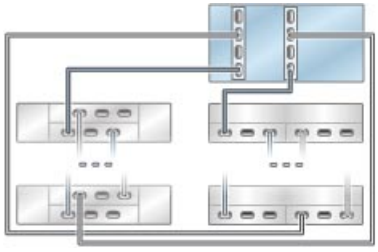


fig.1 Clustered controllers with two HBAs and multiple mixed disk shelves in two chains (DE2-24 on the left).

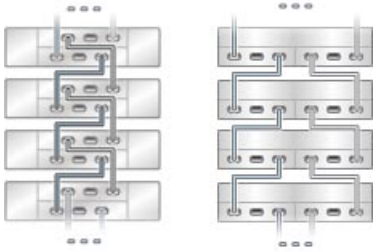


fig.2 Eight disk shelves in two chains (DE2-24 on the left).

ZS3-4/7420 Clustered with DE2 and Sun Disk Shelves

Connecting ZS3-4/7420 Clustered Controllers to Mixed Disk Shelves

The following figures show a subset of the supported configurations for Oracle ZFS Storage ZS3-4/7420 clustered controllers with two HBAs. Using mixed disk shelves on a controller, requires the following:

- The controller must use only 4X4 port SAS-2 HBAs
- Do not use mixed disk shelves in the same chain

Note: For hardware port locations, see the PCIe Options section in the Hardware Maintenance Overview for your controller model. 4X4 port SAS-2 HBAs are only supported with release AK 2013.1.0 and later.

Cable Diagrams

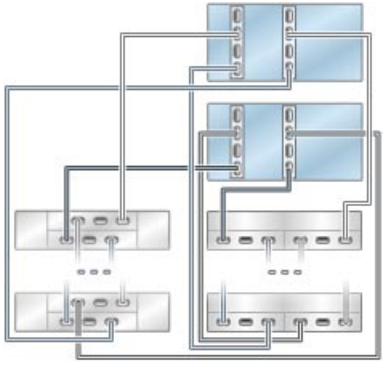


fig.1 Clustered controllers with two HBAs and multiple mixed disk shelves in two chains (DE2-24 on the left).

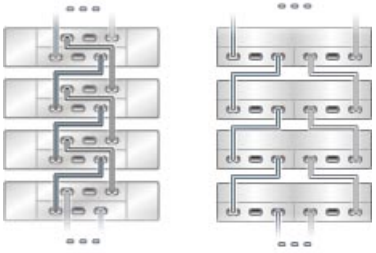


fig.2 Eight disk shelves in two chains (DE2-24 on the left).

◆ ◆ ◆ CHAPTER 3

System Maintenance

System

Introduction

The Maintenance > System screen provides several system-level features. The screen allows the administrator to:

- View the status of the system disks
- Manage software updates and update the system software
- Create and restore appliance configuration backups
- Create and upload a support bundle
- Repeat the initial setup with existing settings
- Reset the system to the factory defaults
- View pending disk firmware updates

System Disks

The system disks section shows the status of the system disks, and their current usage. The BUI displays this with a pie-chart, and the CLI as a text list. For example:

```
tarpon:> maintenance system disks show
Properties:
                        profile = mirror
                           root = 1.14G
                            var = 52.4M
                         update = 2.52M
                          stash = 14.8M
                           dump = 16.0G
                          cores = 18K
                        unknown = 39.0G
                           free = 401G
```

```
Disks:

DISK        LABEL      STATE
disk-000    HDD 7      healthy
disk-001    HDD 6      healthy
```

Note: The "disk" column is not required by the GUI.

Support Bundles

The appliance can generate support bundles containing system configuration information and core files for use by remote support in debugging system failures. Support bundles are generated automatically in response to faults if the Phone Home service is enabled. Administrators can manually generate and upload a support bundle from this section of the Maintenance > System screen.

Once generated, support bundles are automatically uploaded to Oracle's Support files Service at http://support.oracle.com. (`http://support.oracle.com.`) To facilitate this, the appliance must be connected to the Internet, either directly or through the web proxy configured on the Phone Home service screen. If the upload fails, the system will make another attempt.

After a support bundle has been successfully uploaded, the support bundle and core files are automatically deleted from the system.

Managing Support Bundles Using the BUI

To generate a support bundle, click the icon next to **Support Bundles** on the Maintenance > System screen. You are presented with the randomly generated filename for the support bundle. Provide this filename to support personnel so that they can retrieve your support bundle.

For each support bundle currently being generated or uploaded or which has failed to upload, the following options may be available:

Icon	Description
	Cancel the current operation. If the bundle is being generated, it will be deleted. If the bundle is being uploaded, the upload will be cancelled and the appliance will not retry it later.
	Download the support bundle.
	Try again to upload the bundle to support.
	Cancel any pending operation and delete the support bundle.

Managing Support Bundles Using the CLI

To generate and upload a new support bundle, use the `sendbundle` command:

```
loader:> maintenance system
loader:maintenance system> sendbundle
A support bundle is being created and sent to Oracle. You will receive an alert
when the bundle has finished uploading. Please save the following filename, as
Oracle support personnel will need it in order to access the bundle:

   /cores/ak.9a4c3d7b-50c5-6eb9-c2a6-ec9808ae1cd8.tar.gz
```

As the message indicates, you must provide this filename to support personnel in order for them to retrieve your bundle.

Manage bundles from the **`maintenance system bundles`** context in the CLI, as follows:

```
loader:maintenance system> bundles
loader:maintenance system bundles> list
BUNDLE                                                  STATUS      PROGRESS
/cores/ak.9a4c3d7b-50c5-6eb9-c2a6-ec9808ae1cd8.tar.gz   Uploading      7%
loader:maintenance system bundles>
```

Bundles are identified by the filename, omitting the `ak.` prefix and the file type suffix. To delete a support bundle, use the `destroy` command. To view details, use the `select` and `list` commands:

```
loader:maintenance system bundles> select 9a4c3d7b-50c5-6eb9-c2a6-ec9808ae1cd8
loader:maintenance system bundles 9a4c3d7b-50c5-6eb9-c2a6-ec9808ae1cd8> list
Properties:
          filename = /cores/ak.9a4c3d7b-50c5-6eb9-c2a6-ec9808ae1cd8.tar.gz
          status = uploading
                step_progress = 14.709744730821669
```

These read-only properties indicate that the appliance is 14% of the way through uploading the file. To retry a failed upload or cancel a pending operation, enter the `retry` and `cancel` commands respectively.

Initial Setup

Initial setup will step through the tasks performed as part of the initial configuration. This will not change any of the current settings unless explicitly requested. User data on the storage pool (including projects and shares) will not be affected.

To perform an initial setup:

- **`BUI`**: click the "INITIAL SETUP" button on the Maintenance > System screen.
- **`CLI`**: enter the `maintenance system` context, then enter the `setup` command.

Factory Reset

Factory reset will reset the appliance configuration back to factory settings of the current software version, and reboot the appliance. All configuration changes will be lost, and the appliance will need to go through initial configuration again, as when it was first installed. User data on the storage pool (including projects and shares) will not be affected - however the pool will need to be imported as part of the initial setup process.

To perform a factory reset:

- **`BUI`**: click the "FACTORY RESET" button on the Maintenance > System screen.
- **`CLI`**: enter the `maintenance system` context, then issue the `factoryreset` command.
- **`GRUB`**: Add `-c` to the GRUB menu on the line beginning with `kernel`.

`Note`: Factory reset of a single controller while configured into a cluster is not supported. The controller must be unclustered first.

Updates

System Updates

The system update feature provides customers, developers, and field personnel with the ability to update a system's software after the system is installed.

Software updates are delivered as opaque binary downloads that contain some or all of:

- Management and system software.
- Firmware for internal components such as HBAs and network devices.
- Firmware for disks and flash devices.
- Firmware for external storage enclosure components.

In general, the update release notes describe what is in the update, and the update process automates all of the steps of activating the delivered components.

Procedure Overview

The procedure for updating the system is as follows:

- First, the software update *media* is downloaded from an Oracle support website or retrieved from another official source. The media is represented by a single compressed file named after the version number, such as: ak-nas-2013-06-05-0-0.0.pkg.gz. The file can be renamed if needed, as the true version number is recorded internally within the image. The compressed media packages will vary in size, but typically will be on the order of several hundred megabytes.

- Second, the software media is *uploaded* to the appliance. This can be done via either the BUI or the CLI; see below for details of this operation.
- After the media is uploaded, it will be *unpacked* and *verified*. If all verification checks pass, it will appear in the list of update images as eligible for installation. Any number of images can be maintained on the appliance, subject to a system disk space quota, without actually applying them. If an update has not yet been applied (i.e. is not running and is not a rollback target), it can be deleted via either the BUI or the CLI. You might want to delete images in order to free up needed space to download new images.
- Administrators should verify that the system is in a healthy state prior to applying the update. The details are described below in the preconditions section.
- After the media is unpacked and verified, the update can be applied. During this process, an update health check will be performed to verify the appliance is ready to update. You may be asked to set update options and confirm. For more information on these questions, see the section on deferred updates. If the update is no longer appropriate for the system (because you have skipped past its version number), an error message may be provided. During the update, messages and a progress meter will appear to indicate that the update is proceeding. The installation portion of the update will take about half an hour to complete; however, the full upgrade process may not be complete at that point. See below regarding additional firmware upgrades that may take place following the reboot.
- While the upgrade is in progress, up until the reboot and following the reboot during any firmware upgrades, it is **`non-disruptive`**: the controller continues to provide data services to clients. If the system software fails during the upgrade, it will reboot and continue running the software from before the upgrade. **`Important:`** Do not perform a cluster takeover operation or a reboot while an upgrade is in progress.
- Following the post-upgrade reboot, component firmware will be updated (see firmware updates below) which will take additional time that depends on the size of the system configuration and the amount of firmware that has changed since the previously-installed version was delivered; very large configurations may take several hours to complete all firmware upgrades once the update itself has been applied.

For details on the update process using the BUI or CLI, review the sections below.

Preconditions

Best practices include verifying several preconditions prior to applying an update. Whenever possible, administrators should ensure that these preconditions are satisfied immediately prior to applying an update on the storage controller. In a clustered environment, these should be verified on both storage controllers before applying the update to either one.

- Ensure that any resilvering operations have completed. This can be observed in Configuration/Storage or the equivalent CLI context.
- Ensure that there are no active problems.

- Verify that firmware updates are not in progress.
- Check the most recent product release notes for additional preconditions that should be observed for the software release to which you are upgrading.

Update Health Checks

System level health checks are provided to help ensure that no pathologies will interfere with the software update. If a problem is encountered, it is noted in the Alert Log and the update process is aborted. System software updates will not proceed until all problems have been corrected.

You can manually run the same health checks in advance of any planned update. This allows you to check the state of the system prior to scheduling an update maintenance window so you can correct any problems that could interfere with the update process. Any problem report that is issued by a manual health check is identical to that issued by the health checks integrated in the update process. As with the integrated health checks, you are presented with a link to the Alert Log when problems are found. If no problems are found, the `System Ready` state transitions to `Yes` to indicate that the system is ready for software updates.

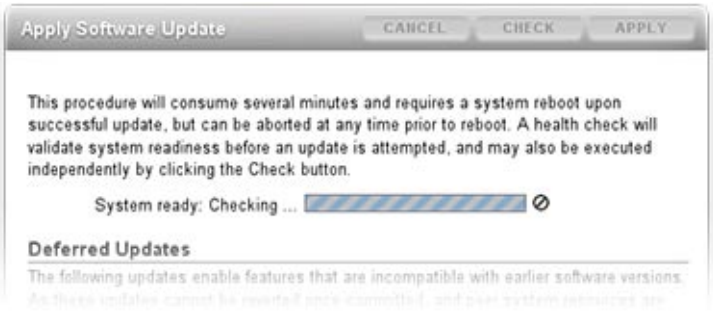
`Note:` Running an update health check does not replace meeting required preconditions. Precondition checks must also be executed and problems resolved prior to updating the system software.

BUI

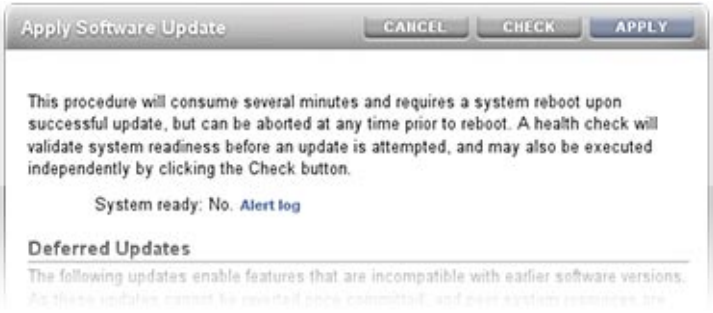
After you select and start an update, update health checks may be issued from the software update dialog box in the BUI.

Apply Software Update
CANCEL
CHECK
APPLY
This procedure will consume several minutes and requires a system reboot upon successful update, but can be aborted at any time prior to reboot. A health check will validate system readiness before an update is attempted, and may also be executed independently by clicking the Check button.
System ready: Unchecked

The system remains in the `Unchecked` state until the Check button is clicked. During the health check operation, an indicator shows its progress.


Apply Software Update
CANCEL
CHECK
APPLY
This procedure will consume several minutes and requires a system reboot upon successful update, but can be aborted at any time prior to reboot. A health check will validate system readiness before an update is attempted, and may also be executed independently by clicking the Check button.
System ready: Checking ...
Deferred Updates
The following updates enable features that are incompatible with earlier software versions.

After completion, the `System Ready` state changes to `Yes` or `No` with a link to the Alert Log.


Apply Software Update
CANCEL
CHECK
APPLY
This procedure will consume several minutes and requires a system reboot upon successful update, but can be aborted at any time prior to reboot. A health check will validate system readiness before an update is attempted, and may also be executed independently by clicking the Check button.
System ready: No. Alert log
Deferred Updates
The following updates enable features that are incompatible with earlier software versions.

CLI

To execute the update health checks via the CLI, execute the `upgrade` command in `maintenance system updates` after selecting the update media:

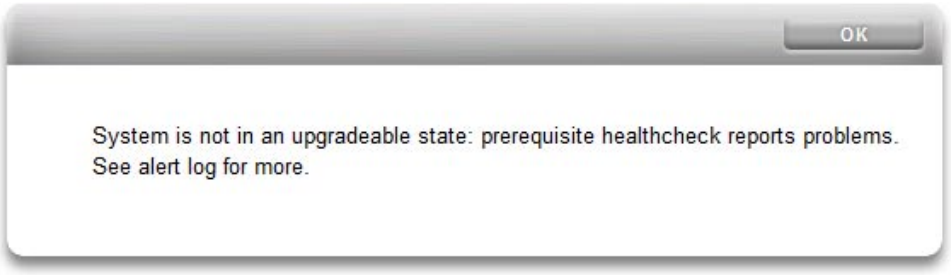
```
dorab:maintenance system updates ak-nas@2013.06.05.0.0,1-1.6> upgrade
This procedure will consume several minutes and requires a system reboot upon
successful update, but can be aborted with [Control-C] at any time prior to
reboot. A health check will validate system readiness before an update is
attempted, and may also be executed independently using the check command.

Are you sure? (Y/N)

 Healthcheck running ... /
 Healthcheck completed.  There are no issues at this time which
 would cause an upgrade to this media to be aborted.
```

Troubleshooting Update Health Check Failures

Prior to the actual update, health checks are performed automatically when an update is started. If an update health check fails, it can cause an update to abort (see Example 1). Update health checks only validate issues that can impact updates.




```
dorab:maintenance system updates ak-nas@2013.06.05.0.0,1-1.6> upgrade
This procedure will consume several minutes and requires a system reboot upon
successful update, but can be aborted with [Control-C] at any time prior to
reboot. A health check will validate system readiness before an update is
attempted, and may also be executed independently using the check command.

Are you sure? (Y/N)
error: System is not in an upgradeable state: prerequisite healthcheck reports problems.
See alert log for more.
```

Example 1. BUI and CLI update health check failures

Actions to Take to Resolve Health Check Alerts

After an update health check failure, you can review the Alert Log and take action to resolve each failure based on the message in the log. The following table lists the update health check failures that can block an update, and describes the associated Alert Log message and recommended order of steps you can take to resolve the issue. For component faults, follow the instructions for removal and installation found in the Maintenance procedures for your controller.

ID and Alert Log Message	Failure	Resolution Steps
B1 "System software update cannot proceed: Slot <label> in disk shelf <name> is reported as absent."	SIM cannot be detected.	1, 2, 4
B2 "System software update cannot proceed: Slot <label> in disk shelf <name> is faulted."	SIM is faulted.	1, 2, 4
C1 "System software update cannot proceed: Some slots of disk shelf <name> have no firmware revision information."	SIM is missing firmware revision information.	1, 4
C2 "System software update cannot proceed: The slots of disk shelf <name> have non-uniform part numbers."	SIMs report different part numbers.	2, 4

ID and Alert Log Message	Failure	Resolution Steps
C5 "System software update cannot proceed: The slots of disk shelf <name> have mixed firmware revisions <rev1> and <rev2>."	SIMs report different firmware revisions.	4
E1 "System software update cannot proceed: Disk shelf <name> has <just one path *or* zero paths>."	Disk shelf does not have two paths.	1, 2, 4
E2 "System software update cannot proceed: Disk shelf <name> path <pathname> is <state>."	Disk shelf path is not online.	1, 2, 4
E3 "System software update cannot proceed: Pool <data *or* log> disk <label> in disk shelf <name> has <just one path *or* zero paths>."	Disk or log device that is configured in a pool does not have two paths.	3, 4
PAN1 "Slot <slot> has a Revision B3 SAS HBA; Revision C0 (or later) required."	A revision B3 SAS HBA is present.	4
PAN2 "J4400 and J4500 disk shelves are not supported in this release."	Disk shelf/shelves are present that are not supported for this software release.	
V1 "<product> is not supported in this release."	Controller (product) is not supported for this software release.	

Take the following steps in the order listed above to resolve the issue detected during the upgrade health check.

1. If a SAS port LED is unlit, check all connections and replace cables as needed.
2. Identify affected chassis, then disconnect and remove faulted SIM. After two minutes, re-seat SIM and wait for steady Power LED before reconnecting cables.
3. Identify affected chassis, and remove faulted disk. After 30 seconds, re-seat disk and wait for steady or flashing LED.
4. Contact Oracle Support for component service or replacement.

Deferred Updates

Each update may come with new firmware or updates to external resources. In general, these updates are backwards-compatible and applied automatically without user intervention. There are exceptions, however, for non-reversible updates. These updates involve updating a resource external to the system software in a way that is incompatible with older software releases. Once the update is applied, rolling back to previous versions will result in undefined behavior. For these updates, you will always be given an explicit option of applying them automatically during upgrade or applying them after the fact. They are therefore referred to as "deferred updates".

When applying an update to a version with incompatible version changes, you will be given an option to apply these version changes as part of the upgrade. For each version change, the benefits of applying the change will be presented to you. The default is to not apply them, requiring you to return to the updates view and apply them once the system has rebooted after the upgrade is applied. This allows you to verify that the rest of the software is functional and a rollback is not required before applying the update.

If you elect to not apply deferred updates during an upgrade, you can return to the updates view at any point to apply the update. If deferred updates are available for the current software version, they will appear as a list below the current set of available updates, with an 'Apply' button to apply the updates. Deferred updates in a cluster take effect on both storage controllers simultaneously, and can only be applied while both controllers are operational. Because deferred updates are listed only for resources present on the local storage controller, in a cluster it may be the case that deferred updates are available only for resources active on the peer controller. In a cluster, it is therefore necessary to check both storage controllers to determine the availability of deferred updates.

Note: Replication does not work across deferred updates. After deferred updates are applied that increment the stream format version, it is no longer possible to replicate to an older system. See Incompatible target Replication Failure for a description.

Feature	Version introduced
"passthrough-x" aclinherit property	2009.Q2.0.0
User quotas	2009.Q3.0.0
COMSTAR	2009.Q3.0.0
Triple-Parity RAID	2009.Q3.0.0
Dedup	2010.Q1.0.0
Replication	2010.Q1.0.0
Received Properties	2010.Q1.0.0
Slim ZIL	2010.Q3.1.0
Snapshot Deletion	2010.Q3.1.0
Recursive Snapshots	2010.Q3.1.0
Multi Replace	2010.Q3.1.0
RAIDZ Mirror	2011.1.0.0
Optional Child Directory	2011.1.0.0
Multiple Initiator Groups per LUN	2011.1.8.0

Reboot After an Update

Following the completion of the update process, the system will reboot automatically. If you have the serial console open, you will notice during this reboot that multiple GRUB menu entries are available, ordered from the newest software (at the top) to the oldest software (at the bottom). The default menu entry will be the top -- the new software to which you just updated. If you do nothing this entry will boot by default, completing the update. The previous entries are *rollback targets* that can be used to initiate a rollback to previous versions of the system software. Rollback is discussed below.

```
 GNU GRUB  version 0.97  (612K lower / 2087424K upper memory)

+-------------------------------------------------------------------------+
| Sun ZFS Storage 7120 2013.06.05.0.0,1-1.6                               |
| Sun ZFS Storage 7120 2011.04.24.4.2,1-1.28                              |
|                                                                         |
+-------------------------------------------------------------------------+
    Use the ^ and v keys to select which entry is highlighted.
    Press enter to boot the selected OS, 'e' to edit the
    commands before booting, or 'c' for a command-line.
```

As the system boots up using the new system software, you will see some special messages on the first boot indicating that an update is completing and noting the previous and new versions of the system software:

```
SunOS Release 5.11 Version ak/generic@2013.06.05.0.0,1-1.6 64-bit
Copyright (c) 1983, 2013, Oracle and/or its affiliates. All rights reserved.

System update in progress.
Updating from: ak/nas@2011.04.24.4.2,1-1.28
Updating to:   ak/nas@2013.06.05.0.0,1-1.6

Cloning active datasets ..... done.
Upgrading /var/ak/home ... 16 blocks
Upgrading /etc/svc/profile ... 176 blocks
Upgrading /var/apache2 ... 4432 blocks
Upgrading /var/sadm ... 5040 blocks
Upgrading /var/svc ... 0 blocks
Upgrading /var/dhcp/duid ... done.
Upgrading /var/pkg ... 208800 blocks
Upgrading /var/ak/logadm.conf ... done.
Adjusting system/dump and system/cores ... done.
Upgrading /var/crypto/pkcs11.conf ... done.
Updating system logs ... done.
Starting primordial svc.configd
Upgrading SMF repository.  This may take several minutes.
   Upgrading from Version 5 to Version 6 :
     11570 of 11570 rows upgraded

   Upgrading from Version 6 to Version 7 :
     6305 of 6305 rows upgraded

   Upgrading from Version 7 to Version 8 :
```

```
SMF repository upgrade complete
SMF online in 180 seconds
Sanitizing manifestfiles properties ... done.
Loading smf(5) service descriptions: 162/162
svccfg: Loaded 162 smf(5) service descriptions
Transitioning NFS server properties ... done.
Re-enabling auditing of Solaris commands ... done.
Transitioning network/initial IPMP properties to network/ipmp ... done.
Transitioning name service properties ... done.
Transitioning CIFS server properties ... done.
Preparing for service import ... done.
Importing adconf.xml ... done.
...
Configuring appliance/kit/identity:default ... done.
Applying service layer ak_generic ... done.
Refreshing services: done.
Applying service layer ak_nas ... done.
Refreshing services: done.
Applying service layer ak_SUNW,iwashi_plus ... done.
Refreshing services: done.
Applying service profile ak_generic ... done.
Applying profile upgrade/akinstall.xml ... done.
Applying layer upgrade/composite.svc ... done.
Cleaning up services ... done.
Shutting down svc.configd ... done.
Configuring devices.
Configuring network devices.

Sun ZFS Storage 7120 Version ak/SUNW,iwashi_plus@2013.06.05.0.0,1-1.6
Copyright (c) 2008, 2013, Oracle and/or its affiliates. All rights reserved.

dorab console login:
```

Hardware Firmware Updates

Following the application of a software upgrade, any hardware for which the upgrade includes newer versions of firmware will be upgraded. There are several types of devices for which firmware upgrades may be made available; each has distinct characteristics.

Disks, storage enclosures, and certain internal SAS devices will be upgraded in the background. When this is occurring, the firmware upgrade progress will be displayed in the left panel of the Maintenance/System BUI view, or in the `maintenance system updates` CLI context. These firmware updates are almost always hardware related, though it may briefly show some number of outstanding updates when applying certain deferred updates to components other than hardware.

As of 2010Q3.4, when there are outstanding updates, an informational or warning icon will appear next to the number of updates remaining. Clicking the icon brings up the Firmware Updates dialog, which lists the current remaining updates. For each update we also show the current version of the component, the time of the last attempted update, as well as the reason why the last attempt didn't succeed.

We consider any outstanding updates to be in one of 3 states: Pending, In Progress and Failed. An update begins in the Pending state, and is periodically retried, at which time it moves into the In Progress state. If we fail to upgrade, due to a transient condition, the upgrade is moved back to the Pending state, and otherwise to the Failed state.

In general, it is only an indication of a problem if:

- There are updates in the Failed state.
- Updates remain in the Pending state (or in limbo between the Pending and In Progress states) for an extended period of time (more than half an hour), without the number of remaining updates decreasing.

The following conditions don't indicate a problem:

- Disks firmware updates are shown as pending for extended periods of time, with a status message indicating that they are not part of any pool. This is expected, given that we only update disk firmware, for disks that are part of a pool. In order to update these disks, add them to a pool.
- There are multiple chassis being updated, we are making progress (the number of remaining updates decreases), and some of the chassis transiently appear pending with a status indicating that some disk has only one path. This is also expected, since when we update a chassis, we may reset one of its expanders. Resetting an expander causes some disks to temporarily have only one path, and as a result, upgrades to other chassis will be held back until it is safe to do so again non-disruptively.

Note that currently the Firmware Updates dialog doesn't automatically refresh, so you would have to close it and re-open it to get an updated view.

Applying hardware updates is always done in a completely safe manner. This means that the system may be in a state where hardware updates cannot be applied. This is particularly important in the context of clustered configurations. During takeover and failback operations, any in-progress firmware upgrade will be completed; pending firmware upgrades will be suspended until the takeover or failback has completed, at which time the restrictions described below will be reevaluated in the context of the new cluster state and, if possible, firmware upgrades will resume. **`Important:`** Unless absolutely necessary, takeover and failback operations should not be performed while firmware upgrades are in progress. The rolling upgrade procedure documented below meets all of these best practices and addresses the per-device-class restrictions described below. It should always be followed when performing upgrades in a clustered environment. In both clustered and standalone environments, these criteria will also be reevaluated upon any reboot or diagnostic system software restart, which may cause previously suspended or incomplete firmware upgrades to resume.

- Components internal to the storage controller (such as HBAs and network devices) other than disks and certain SAS devices will generally be upgraded automatically during boot; these upgrades are not visible and will have completed by the time the management interfaces become available.

- Upgrading disk or flash device firmware requires that the device be taken offline during the process. If there is insufficient redundancy in the containing storage pool to allow this operation, the firmware upgrade will not complete and may appear "stalled." Disks and flash devices that are part of a storage pool which is currently in use by the cluster peer, if any, will not be upgraded. Finally, disks and flash devices that are not part of any storage pool will not be upgraded.
- Upgrading the firmware in a disk shelf requires that both back-end storage paths be active to all disks within all enclosures, and for storage to be configured on all shelves to be upgraded. For clusters with at least one active pool on each controller, these restrictions mean that disk shelf firmware upgrade can be performed only by a controller that is in the "owner" state.

During the firmware upgrade process, hardware may appear to be removed and inserted, or offlined and onlined. While alerts attributed to these actions are suppressed, if you are viewing the Maintenance/Hardware screen or the Configuration/Storage screen, you may see the effects of these upgrades in the UI in the form of missing or offline devices. This is not a cause for concern; however, if a device remains offline or missing for an extended period of time (several minutes or more) even after refreshing the hardware view, this may be an indication of a problem with the device. Check the Maintenance/Problems view for any relevant faults that may have been identified. Additionally, in some cases, the controllers in the disk shelves may remain offline during firmware upgrade. If this occurs, no other controllers will be updated until this condition is fixed. If an enclosure is listed as only having a single path for an extended period of time, check the physical enclosure to determine whether the green link lights on the back of the SIM are active. If not, remove and re-insert the SIM to re-establish the connection. Verify that all enclosures are reachable by two paths.

Rollback

The rollback procedure reverts all of the system software and all of the metadata settings of the system back to their state just prior to applying an update. This feature is implemented by taking a snapshot of various aspects of the system before the new update is applied, and rolling back this snapshot to implement the rollback. The implications of rollback are as follows:

- Any appliance configuration changes are reverted and lost. For example, assume you are running version V, and then you update to V+1, and then you change your DNS server. If you execute a rollback, then your DNS server setting modification is effectively undone and removed from the system permanently.
- Conversely, any changes made to *user data* are **not** reverted: if you update from V to V+1, and clients then create directories or modify shares in any way, those changes still exist after the rollback (as you would expect).
- If the appliance is running version V, and has previous rollback targets V-1 and V-2, and you revert all the way to version V-2 (thereby "skipping" V-1), then you not only are removing the system software settings and system software for V, but also for V-1. That is, after a rollback to V-2, it is as if updates V-1 and V never happened. However, the software

upload images for V-1 and V will still be saved on the system and you can apply them again after the rollback if you wish by re-executing the update.

If after applying an update, the system is back up and running, you can use either the BUI or the CLI to initiate a rollback to one of two previously applied updates. If the system is not able to run at all after an update, then use the fail-safe rollback procedure.

Fail-safe Rollback

Administrators can execute a fail-safe rollback of the system software from the serial console by selecting one of the other boot menu entries, if present. Although rollback can also be requested from the BUI or CLI, rollback is offered from the boot menu because it is possible that rollback will be needed in scenarios where the new system software has completely failed, i.e. has failed to even boot. To rollback from the console, access the serial console as usual, and during boot, before the ten second timeout, use the arrow key to move the menu selection down to one of the earlier entries:

```
   GNU GRUB  version 0.97  (612K lower / 2087424K upper memory)

+-------------------------------------------------------------------------+
| Sun ZFS Storage 7120 2013.06.05.0.0,1-1.6                               |
| Sun ZFS Storage 7120 2011.04.24.4.2,1-1.28                              |
|                                                                         |
+-------------------------------------------------------------------------+
     Use the ^ and v keys to select which entry is highlighted.
     Press enter to boot the selected OS, 'e' to edit the
     commands before booting, or 'c' for a command-line.
```

After the rollback boot menu entry is selected, the system will boot the old kernel software, but the rollback must be manually confirmed on the console in order to commit the rollback, which will effectively remove all changes to the system that have happened since, as described above. The confirmation step looks like this:

```
SunOS Release 5.11 Version ak/generic@2011.04.24.4.2,1-1.28 64-bit
Copyright (c) 1983, 2010, Oracle and/or its affiliates. All rights reserved.

System rollback in progress.
Rollback to: ak/nas@2011.04.24.4.2,1-1.28

Proceed with system rollback [y,n,?]
```

Entering "y" proceeds with the rollback, and the system will complete boot using the prior snapshot. Entering "n" cancels the rollback and immediately reboots the system, allowing the administrator to select a different boot image (i.e. the current system software or an older snapshot).

Cluster Upgrade

In a clustered system, a *rolling upgrade* can be performed, eliminating downtime while the upgrade is performed. This section assumes familiarity with the Oracle ZFS Storage Appliance clustering model: if you are not familiar with the clustering concepts and terminology, please read about clustering concepts in the System Administration Guide first. To describe the rolling upgrade procedure, this document will refer to the two clustered storage controllers as A and B, where A is the controller that will be updated first, and B is the controller that will be updated second. A key best practice in rolling upgrades is that each controller should be upgraded at a time when it is not providing service to clients. The procedure described here meets this requirement. In addition, all general upgrade best practices described above also apply to rolling upgrades.

`Important:` Do not perform a takeover operation while an upgrade is in progress.

1. Use the CLI or BUI to upload the software update image to both storage controllers.
2. Select which controller to update first. If a controller has no storage pools, update that controller first. In the following steps controller A is updated first so if any clients are using controller A's storage pool(s) they will experience a takeover-induced availability delay first.
3. Log in to controller A and use the CLI `maintenance system reboot` command or the BUI power icon in the masthead and select the reboot option to reboot controller A. Controller B takes over resources from controller A.
4. Log in to controller A and use the CLI or BUI to apply the software update to controller A. At the end of the upgrade, controller A reboots again and runs the new software version. **`Important:`** Do not perform an upgrade on a controller while it is providing service.
5. Log in to controller B and use the CLI `maintenance system reboot` command or the BUI power icon in the masthead and select the reboot option to reboot controller B. Controller A takes over all resources and provides service using the new software version.
6. Validate the new software version on controller A and ensure that all services work correctly on the client systems.
7. If a serious problem appears, roll back controller A. Controller A reboots and controller B takes over and runs the previous software version. When controller A recovers, it will also run the previous software version.
8. If no serious problem appears, log in to controller B and use the CLI or BUI to apply the software update to controller B. Controller B reboots and runs the new software version.
9. Verify that all firmware updates complete. **`Important:`** Controller firmware updates cannot proceed if the controllers are running different system software versions.
10. To restore normal operation and return resources to their respective assigned controllers, log in to controller A and use the CLI or BUI to perform a failback on controller A.

The following table describes the state of the cluster after each step of the previous procedure.

Step	Controller A State	Controller A Version	Controller B State	Controller B Version
1,2	CLUSTERED	V	CLUSTERED	V
3	STRIPPED	V	OWNER	V
4	STRIPPED	V+1	OWNER	V
5, 6, 7	OWNER	V+1	STRIPPED	V
8, 9	OWNER	V+1	STRIPPED	V+1
10	CLUSTERED	V+1	CLUSTERED	V+1

`Do not make configuration changes to either storage controller while an upgrade is in progress`. While controllers are running different software versions, configuration changes made to one controller will *not* be propagated to its peer controller.

Accessing the BUI or logging into the CLI while the controllers are running different software versions generates a warning that your configuration changes will not be propagated. You can configure the appliance to generate alerts when the cluster controllers are running different software versions (events "Cluster rejoin mismatch" and "Cluster rejoin mismatch on peer").

If you change the root password during an upgrade and then rollback the cluster, the nodes will not be able to re-join after the rollback.

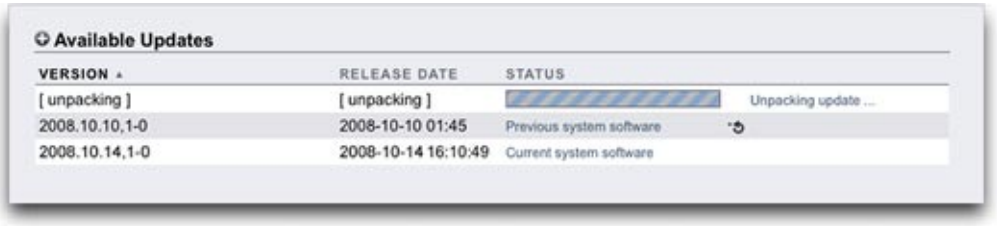
Updating via the BUI

Click the add icon next to **`Available Updates`** and specify the pathname on your desktop or local client of the update media. During the upload, a progress bar is displayed indicating the progress of the upload:

Note that on some older browsers, the progress bar may not be updated continuously during the upload; if you see a "watch" cursor just wait a minute -- in the worst case the upload will proceed all the way to completion and you may not see the progress bar.

Unpacking and Verifying Media

This step will happen automatically after the media is done uploading:



Beginning the Upgrade

After the update is uploaded, unpacked and verified, it will appear as an update:

Click the information icon to view the Release Notes for the software update.

To begin the upgrade, click on the apply icon. During this process, an update health check will be performed to verify the appliance is ready to update. As the upgrade progresses, you will see the most recent message in the status field of the update. To cancel the update at any time (and without ill effect), click on the cancel icon.

Rolling Back

To roll back, locate a previous image and click on the rollback icon. You will be asked to confirm that you wish to execute a rollback, and then the system will reboot and execute the rollback. Unlike fail-safe rollback, you will not be asked for further confirmation when the system reboots.

Removing Update Media

To remove update media, highlight the corresponding row and click on the trash icon.

Applying Deferred Updates

Any deferred updates will be displayed below the list of available updates. If no deferred updates are available, no list will be displayed. The deferred updates will describe what effects they will

have on the system. Clicking the 'Apply' button will apply all available deferred updates. Deferred updates will apply to both nodes in a cluster, and the cluster peer must be up and available to apply any deferred updates.

Updating via the CLI

Because you log into the appliance to use the CLI, the **upload** as described above is actually a **download**. To download the media onto the appliance via the CLI, execute the `download` command in `maintenance system updates`:

```
dory:maintenance system updates> download
dory:maintenance system updates download (uncommitted)> get
                          url = (unset)
                         user = (unset)
                     password = (unset)
```

You must set the "`url`" property to be a valid URL for the download. This may be either local to your network or over the internet. The URL can be either HTTP (beginning with "http://") or FTP (beginning with "ftp://"). If user authentication is required, it may be a part of the URL (e.g. "ftp://myusername:mypasswd@myserver/export/foo"), or you may leave the username and password out of the URL and instead set the user and password properties.

```
dory:maintenance system updates download (uncommitted)> set url=
   ftp://foo/update.pkg.gz
                          url = ftp://foo/update.pkg.gz
dory:maintenance system updates download (uncommitted)> set user=bmc
                         user = bmc
dory:maintenance system updates download (uncommitted)> set password
Enter password:
                     password = ********
dory:maintenance system updates download (uncommitted)> commit
Transferred 157M of 484M (32.3%) ...
```

Unpacking and Verifying Media

After the file has been transferred, it will be automatically unpacked and verified:

```
dory:maintenance system updates download (uncommitted)> commit
Transferred 484M of 484M (100%) ... done
Unpacking ... done
dory:maintenance system updates> list
UPDATE                          DATE                      STATUS
ak-nas@2009.10.14,1-0-nd        2009-10-14 08:45          AKUP_WAITING
...
```

Beginning an Upgrade

To begin an upgrade, select the update that constitutes the upgrade. During this process, an update health check will be performed to verify the appliance is ready to update.

NOTE: If the update is no longer appropriate for the system (because you have skipped past its version number), an error message may be provided.

From this context, you can set any properties specific to the update, including applying deferred updates. For more information on the set of properties available for the particular update, run the `help properties` command. User-controllable properties will begin with the `update_` prefix:

```
clownfish:maintenance system updates ak-nas@2009.04.03,1-0> help properties
Properties that are valid in this context:

   version              => Update media version

   date                 => Update release date

   status               => Update media status

   update_zfs_upgrade   => Apply incompatible storage pool update

clownfish:maintenance system updates ak-nas@2009.04.03,1-0> get
                       version = 2009.04.03,1-0
                          date = 2009-4-3 08:45:01
                        status = AKUP_WAITING
            update_zfs_upgrade = deferred
clownfish:maintenance system updates ak-nas@2009.04.03,1-0> set update_zfs_upgrade=onreboot
            update_zfs_upgrade = onreboot
clownfish:maintenance system updates ak-nas@2009.04.03,1-0>
```

After you set any properties, execute the `upgrade` command. You are prompted for confirmation and (assuming an affirmative) the upgrade begins:

```
dory:maintenance system updates> select ak-nas@2009.10.14,1-0-nd
dory:maintenance system updates ak-nas@2009.10.14,1-0-nd> upgrade
The selected software update requires a system reboot in order to take effect.
The system will automatically reboot at the end of the update process. The
update will take several minutes. At any time during this process, you can
cancel the update with [Control-C].

Are you sure? (Y/N) y
Updating from ... ak/nas@2009.10.11,1-0
Backing up smf(5) ... done.
Loading media metadata ... done.
Selecting alternate product ... SUNW,iwashi
Installing Sun Storage 7120 2009.10.14,1-0
pkg://sun.com/ak/SUNW,iwashi@2009.10.14,1-0:20091014T084500Z
Creating system/boot/ak-nas-2009.10.14_1-0 ... done.
Creating system/root/ak-nas-2009.10.14_1-0 ... done.
...
```

As the upgrade proceeds, the latest message will be printed. You can cancel the upgrade at any time by pressing `^C`, at which point you will be prompted for confirmation:

```
Updating from ... ak/nas@2009.10.11,1-0
Backing up smf(5) ... done.
Loading media metadata ... ^C
```

```
This will cancel the current update. Are you sure? (Y/N) y
error: interrupted by user
dory:maintenance system updates ak-nas@2009.10.14,1-0-nd>
```

Rolling Back

To roll back to an earlier version, select the update that corresponds to that version and execute the `rollback` command. You will be asked to confirm that you wish to execute a rollback, and then the system will reboot and execute the rollback. Unlike fail-safe rollback, you will not be asked for further confirmation when the system reboots.

Removing Update Media

To remove update media, use the `destroy` command, specifying the update to be removed:

```
dory:maintenance system updates> destroy ak-nas@2009.10.14,1-0-nd
This will destroy the update "ak-nas@2009.10.14,1-0-nd". Are you sure? (Y/N) y
dory:maintenance system updates>
```

Applying Deferred Updates (CLI)

To see if there are any available deferred updates, run the `show` command. If deferred updates are available, you can use the `apply` command:

```
clownfish:maintenance system updates> show
Updates:

UPDATE                                  DATE                    STATUS
ak-nas@2011.04.24.3.0,1-2.19.11.2       2012-6-24 17:14:19      current
ak-nas@2011.04.24.4.2,1-1.28            2012-11-5 03:11:34      waiting
ak-nas@2013.06.05.0.0,1-1.2             2013-6-19 12:58:18      unavailable
```

Waiting media is listed as unavailable if the currently-active software is not sufficiently recent to be able to upgrade to that waiting media. In this example, media has been downloaded for both 2011.1.4.2 and 2013.1 but the 2013.1 upgrade is unavailable because you first need to upgrade to at least 2011.1.4.2.

```
Deferred updates:

The following incompatible updates are available. Applying these updates will
enable new software features as described below, but will prevent older
versions of the software from accessing the underlying resources. You should
apply deferred updates once you have verified that the current software update
is functioning and a rollback is not required. Applying deferred updates in a
cluster will also update any resources on the cluster peer.

1. Support for the "passthrough-x" aclinherit property for shares.
clownfish:maintenance system updates> apply
Applying deferred updates will prevent rolling back to previous versions of
software.

Are you sure? (Y/N)
clownfish:maintenance system updates> apply
```

Passthrough x

Passthrough-x Deferred Update

For filesystems, ACLs are inherited according to the "aclinherit" property on the filesystem (or inherited from the project). Previous versions of software allowed four options for this setting: "discard", "noallow", "restricted", and "passthrough". The 2009.Q2.0.0 release introduces a new option, "passthrough-x", with slightly different semantics as described in the product documentation:

Same as 'passthrough', except that the owner, group, and everyone ACL entries inherit the execute permission only if the file creation mode also requests the execute bit.

The "passthrough" mode is typically used to cause all "data" files to be created with an identical mode in a directory tree. An administrator sets up ACL inheritance so that all files are created with a mode, such as 0664 or 0666. This all works as expected for data files, but you might want to optionally include the execute bit from the file creation mode into the inherited ACL. One example is an output file that is generated from tools, such as "cc" or "gcc". If the inherited ACL doesn't include the execute bit, then the output executable from the compiler won't be executable until you use chmod(1) to change the file's permissions.

In order to use this new mode, the storage pool must be upgraded. If you choose not to upgrade the pool and attempt to use this new property, you will get an error indicating that the storage pool needs to be upgraded first. There is no other implication of applying this update, and it can be ignored if there is no need to use this new setting. Applying this update is equivalent to upgrading the on-disk ZFS pool to ZFS Pool Version Summary.

User Quotas

User Quotas Deferred Update

With the 2009.Q3 software release, the system now supports user and group quotas on a per-share basis. In order to make use of this feature, a deferred update must be applied to upgrade all shares in the system to support this feature. Applying this deferred update also allows the current usage (user or group) to be queried on a per-filesystem or per-project basis. To quote the product documentation:

Quotas can be set on a user or group at the filesystem level. These enforce physical data usage based on the POSIX or Windows identity of the owner or group of the file or directory. There are some significant differences between user and group quotas and filesystem and project data quotas.

Be sure to read the complete documentation under Space Management before attempting to use user or group quotas.

This update is applied in the background, and takes time proportional to the number of shares and amount of data on the system. Until this deferred update is finished, attempt to apply user quotas will produce an error indicating that the update is still in progress.

COMSTAR

COMSTAR Deferred Update

The COMSTAR framework relies on a ZFS pool upgrade for complete support of persistent group reservations (PGRs). Before this upgrade has been applied, the number of reservations stored with each LUN is severely limited, and may even be zero.

Applying this update is equivalent to upgrading the on-disk ZFS pool to version 16.

Triple Parity RAID

Triple-Parity RAID Deferred Update

This update provides the ability to use the triple-parity RAID storage profile, RAID-Z with three parity sectors per stripe. Triple-parity offers increased protection against drive failures and additional overall availability.

In order to use this new mode, the storage pool must be upgraded. If you choose not to upgrade the pool and attempt to use this new property, you will get an error indicating that the storage pool needs to be upgraded first. There is no other implication of applying this update, and it can be ignored if there is no need to use this new setting. Applying this update is equivalent to upgrading the on-disk ZFS pool to version 17.

Dedup

Data Deduplication Deferred Update

This update provides the ability to use data deduplication.

In order to use this new mode, the storage pool must be upgraded. If you choose not to upgrade the pool and attempt to use this new property, you will get an error indicating that the storage pool needs to be upgraded first. There is no other implication of applying this update, and it can be ignored if there is no need to use this new setting. Applying this update is equivalent to upgrading the on-disk ZFS pool to version 21.

Replication

Replication Deferred Update

The 2010.Q1 release stores replication configuration differently than 2009.Q3 and earlier releases. This update migrates existing target, action, and replica configuration created under an earlier release to the new form used by 2010.Q1 and later.

After upgrading to 2010.Q1 but before this update is applied, incoming replication updates for existing replicas will fail. Replicas received under earlier releases will not be manageable via the BUI or CLI, though they will occupy space in the storage pool. Additionally, the system will not send replication updates for actions configured on earlier releases.

After applying this update, incoming replication updates for replicas originally received on earlier releases will continue normally and without a full resync. The system will also send incremental replication updates for actions configured under earlier releases.

Received Properties

Received Properties Deferred Update

The 2010.Q1 feature that enables administrators to customize properties on replicated shares relies on a ZFS pool upgrade. This upgrade provides support of persistent local changes to received properties. Before this upgrade has been applied, the system will not allow administrators to change properties on replicated shares.

Applying this update is equivalent to upgrading the on-disk ZFS pool to version 22.

Slim ZIL

Introduction

This deferred update changes the layout of ZFS intent log blocks to improve synchronous write performance. These improvements rely on a ZFS pool upgrade provided by this update. Before this update has been applied, log records will continue to be written in the old format and performance may be reduced.

Applying this update is equivalent to upgrading the on-disk ZFS pool to version 23.

Snapshot Deletion

Snapshot Deletion Deferred Update

This deferred update increases snapshot deletion parallelism and reduces the size of transaction groups associated with snapshot deletion to improve systemic responsiveness. These improvements rely on a ZFS pool upgrade provided by this update. Before this update has been applied, new snapshot data will be stored in the old format and deleted using the old algorithm. Note that any snapshots created before this update is applied will also be deleted using the old algorithm.

Applying this update is equivalent to upgrading the on-disk ZFS pool version 26.

Recursive Snapshots

Recursive Snapshots Deferred Update

This deferred update allows recursive snapshots to be taken without suspending the ZFS intent log, which greatly improves snapshot creation performance especially on heavily loaded controllers. These improvements rely on a ZFS pool upgrade provided by this update. Before this update has been applied, the system will be able to create snapshots but will do so using the old, much slower, algorithm.

Applying this update is equivalent to upgrading the on-disk ZFS pool to version 27.

Multi Replace

Multi Replace Deferred Update

This deferred update allows importing a pool with a missing log device and corrects the behavior of the system when a device that is being resilvered is itself removed or replaced. These fixes rely on a ZFS pool upgrade provided by this update. Before this update has been applied, the system will be unable to import pools with missing log devices and will not correctly handle replacement of resilvering devices (see CR 6782540).

Applying this update is equivalent to upgrading the on-disk ZFS pool to version 28.

RAIDZ Mirror

RAIDZ/Mirror Deferred Update

This deferred update improves both latency and throughput on several important workloads. These improvements rely on a ZFS pool upgrade provided by this update. Applying this update is equivalent to upgrading the on-disk ZFS pool to version 29.

Optional Child Dir

Introduction

This deferred update improves list retrieval performance and replication deletion performance by improving dataset rename speed. These improvements rely on a ZFS pool upgrade provided by this update. Before this update has been applied, the system will be able to retrieve lists and delete replications, but will do so using the old, much slower, recursive rename code. Applying this update is equivalent to upgrading the on-disk ZFS pool to version 31.

Multiple Initiator Groups per LUN

Introduction

This deferred update allows a LUN to be associated with more than one initiator group at a time. If replicating LUNs with this update applied, also apply the update to the replication target system(s).

ConfigurationBackup

Configuration Backup

The configuration backup function enables the administrator to:

- **`Backup`** the appliance configuration, consisting of system metadata only (such as the network configuration, local users and roles, service settings, and other appliance metadata).
- **`Restore`** a previously saved configuration from a backup.
- **`Export`** a saved configuration, as a plain file, so that it may be stored on an external server, or included in a backup of a share on the appliance itself.
- **`Import`** a saved configuration that was previously exported from this system or another system, making it available for a restore operation.

Backup Contents

A configuration backup **`does`** include:

- Metadata associated with the system as a whole, such as settings for NTP, NIS, LDAP, and other services.
- Network device, datalink, and interface configuration.
- User accounts, roles and privileges, preferences, and encrypted passwords for local users (not directory users).
- Alerts and thresholds and their associated rules.

`NOTE`: In a cluster configuration, configuration backups are visible only on the node on which they were created or imported.

A configuration backup **`does not`** include:

- User data (shares and LUNs). Your user data must be backed up separately, using NDMP backup software, snapshots, and/or remote replication.

- User passwords for directory users. These remain stored solely in your separate network directory service, such as LDAP or Active Directory, and will not be stored in the backup or restored.
- Metadata directly associated with user data, such as snapshot schedules, user quotas, compression settings, and other attributes of shares and LUNs.
- Analytics and logs. Events can be redirected to external SNMP trap receivers or e-mail destinations using Alerts rules.
- System software. The system software is automatically backed up as part of the System Update capability.

Restore Impact

The restore operation takes a selected configuration backup, and modifies all of the corresponding system settings to reflect those in the backup, including removing aspects of the configuration that were not present at the time of the backup. Administrators should adhere to the following guidelines when planning a restore:

- **Scheduled downtime** - The restore process takes several minutes to complete and will impact service to clients, as the active networking configuration and data protocols are reconfigured. Therefore, a configuration restore should only be used on a development system, or during a scheduled downtime.
- **Service interruption** - Clients accessing data on the system through a data protocol such as NFS will see service interrupted, as the network is reconfigured and the NFS service restarted. If the selected backup copy was taken when a service was disabled by the administrator, that setting will be restored, and therefore client sessions will be terminated for that protocol.
- **Session interruption** - If restore is initiated from a web browser, that web browser session will also be disconnected during the restore process as the network is reconfigured. If the restored configuration does not include the same routing and network address settings used by the current browser connection, or if the browser is connected to a network address managed by DHCP, the browser session will be interrupted during the restore. The restore process will complete in the background, but you will need to reload or point the browser at a new, restored network address to continue. For this reason, it may be desirable to initiate a complex configuration restore from the service processor serial console using the CLI.
- **Un-cluster, restore, and re-cluster** - Configuration backups may be initiated for appliances that are joined in a cluster, but a configuration restore may **not** be used while systems are actively clustered. The clustering process means that settings are being synchronized between cluster peers, and each peer appliance also is maintaining private settings. For this reason, you must first use the Unconfiguring Clustering procedure to un-cluster the two systems. Then, restore the configuration backup on a selected head, and then re-cluster the two systems, at which point the other system will automatically synchronize itself with the restored configuration.

- **Root privileges required** - Configuration backups include all system metadata, and therefore require all possible privileges and authorizations to create or apply. Therefore, unlike other delegated administrative options, **only** the root user is authorized to perform a configuration backup or restore.
- **Verify setting for new features** - It is permitted to restore a configuration that was saved before applying a system update to a new version of the appliance software. In some cases, services and properties that were present at the time of the backup may have different effects, and new services and properties may exist in the newer software that did not exist at the time of the backup. Similar to the system update process, the configuration restore process will make every effort to transfer applicable settings, and apply reasonable defaults to those properties that did not exist at the time of the backup. When restoring across software versions, administrators should manually verify settings for new features following the restore.
- **Password maintenance** - The root password is **not** changed or reverted to the password at the time of the backup if it was different. The current root password is maintained on the system across the restore. For more details about passwords, refer to the summary of Security Considerations.

Security Considerations

A configuration backup contains information that is normally only accessible to the root administrative user on the appliance. Therefore, any configuration backup that is exported to another system or into a filesystem share must apply security restrictions to the backup file to ensure that unauthorized users cannot read the backup file.

Local user passwords are stored in the backup file in encrypted (hashed) format, not as clear text. However, on the system, access to these password hashes is restricted, as they could be used as input to dictionary attacks. Therefore, administrators must carefully protect configuration backups that are exported, either by restricting file access to the backup, or by applying an additional layer of encryption to the entire backup file, or both.

Directory user passwords are **not** stored in the appliance, and therefore are not stored in the configuration backup. If you have deployed a directory service such as LDAP or AD for administrative user access, there are no copies of directory service password hashes for directory users stored in the configuration backup. Only the user name, user ID, preferences, and authorization settings for directory users are stored in the backup and then restored.

Following a configuration restore, the local **root** administrative user password is **not** modified to the root password at the time of the backup. The root password is left as-is, unmodified, by the restore process, to ensure that the password used by the administrator who is executing the restore process (and thus has logged in, using that password) is retained. If the administrator's intent was to also change the root password at the time of configuration restore, that step must be executed manually following the restore, using the normal administrative password change procedure.

Managing Configuration Backups Using the BUI

The following section outlines how various Configuration Backup tasks can be accomplished using the Configuration Backup area near the bottom of the Maintenance > System screen in the BUI.

Create a Configuration Backup

To create a backup, simply click the "Backup" button above the list of saved configurations and follow the instructions. You will be prompted to enter a descriptive comment for the backup.

Restore from a Saved Configuration

Click the rollback icon on any saved configuration to begin the process of reverting the system to that saved configuration. Review the Restore Impact guidance above, and confirm that it is ok to proceed.

Delete a Saved Configuration

To delete a Saved Configuration simply click the trash can icon to delete the configuration that is no longer required.

Export a Saved Configuration

To export a Saved Configuration, mouse over the configuration list entry you wish to export and click the download icon. Your browser will prompt you to save the file locally. The file is a compressed archive whose contents are versioned and may vary over time. You should **not** attempt to unpack or modify the content of the archive, and doing so will render it unable to be imported back to the appliance successfully.

Import a Saved Configuration

To import a previously exported Saved Configuration, click the add icon at the top of the saved configurations list and then use your web browser's file selection dialog to locate the previously exported configuration. You should upload the single, compressed archive file previously saved using the export function.

Managing Configuration Backups Using the CLI

The following section outlines how various Configuration Backup tasks can be accomplished using the CLI in the `maintenance system configs` context.

Listing Configurations

```
host:maintenance system configs> list
CONFIG                               DATE                SYSTEM   VERSION
bfa614d7-1db5-655b-cba5-bd0bb0a1efc4 2009-8-5 17:14:28   host      2009.08.04,1-0
cb2f005f-cf2b-608f-90db-fc7a0503db2a 2009-8-24 17:56:53  host      2009.08.18,1-0
```

Create a Configuration Backup

The backup command saves a configuration backup. You will be prompted to enter a descriptive comment for the backup, and then enter done to execute the backup operation.

```
host:maintenance system configs> backup
Backup Configuration. Enter a descriptive comment for this configuration, and
click Commit to backup current appliance settings:
host:maintenance system configs conf_backup step0> set comment="pre-upgrade"
                      comment = pre-upgrade
host:maintenance system configs conf_backup step0> done
host:maintenance system configs>
```

Restore from a Saved Configuration

The restore command reverts the system to a saved configuration. You will be prompted to enter the universal unique identifier for the backup (see the output of list, above), and then enter done to execute the restore. Review the Restore Impact guidance above, and confirm that it is ok to proceed.

```
host:maintenance system configs> restore
Restore. Select the configuration to restore:
host:maintenance system configs conf_restore step0>
    set uuid=36756f96-b204-4911-8ed5-fefaf89cad6a
                          uuid = 36756f96-b204-4911-8ed5-fefaf89cad6a
host:maintenance system configs conf_restore step0> done
```

Note: Storage pools are not automatically unconfigured when you execute the restore command.

Delete a Saved Configuration

Then the destroy command deletes a saved configuration:

```
host:maintenance system configs> destroy cb2f005f-cf2b-608f-90db-fc7a0503db2a
Are you sure you want to delete the saved configuration "new"? y
host:maintenance system configs>
```

Export a Saved Configuration

The export command exports a saved configuration, by means of executing an HTTP or FTP PUT operation against a remote HTTP or FTP server. You can also use the export function to

export the file to a share on the appliance itself, that has the HTTP or FTP protocol enabled for writing. You can enter a username and password for authentication to the remote server if one is required.

Import a Saved Configuration

The `import` command imports a saved configuration, by means of executing an HTTP or FTP GET operation against a remote HTTP or FTP server. You can also use the import function to import a configuration stored in a share on the appliance itself, that has the HTTP or FTP protocol enabled for reading. You can enter a username and password for authentication to the remote server if one is required.

Problems

Problems

To aid serviceability, the appliance detects persistent hardware failures (*faults*) and software failures (*defects*, often included under faults) and reports them as active problems on this screen. If the phone home service is enabled, active problems are automatically reported to Oracle Support, where a support case may be opened depending on the service contract and the nature of the fault.

Active problems display

For each problem, the appliance reports what happened, when the problem was detected, the severity and type of the problem, and whether it has been phoned home. Below are some example faults as they would be displayed in the BUI:

Date	Description	Type	Phoned Home
2009-09-16 13:56:36	SMART health-monitoring firmware reported that a disk failure is imminent.	Major Fault	Never
2009-09-05 17:42:55	A disk of a different type (cache, log, or data) was inserted into a slot. The newly inserted device must be of the same type.	Minor Fault	Never
2009-08-21 16:40:37	The ZFS pool has experienced currently unrecoverable I/O failures.	Major Error	Never
2009-07-16 22:03:22	A memory module is experiencing excessive correctable errors affecting large numbers of pages.	Major Fault	Never

This information can also be viewed in the CLI:

```
gefilte:> maintenance problems show
Problems:

COMPONENT    DIAGNOSED           TYPE            DESCRIPTION
problem-000  2010-7-27 00:02:49  Major Fault     SMART health-monitoring
                                                 firmware reported that a
                                                 failure is imminent on disk
                                                 'HDD 17'.
```

Selecting any fault shows more information about the fault including the impact to the system, affected components, the system's automated response (if any), and the recommended action for the administrator (if any). In the CLI, only the "uuid", "diagnosed", "severity", "type", and "status" fields are considered stable. Other property values may change from release to release.

For hardware faults, you may be able to select the affected hardware component to locate it on the Hardware screen.

Repairing problems

Problems can be repaired by performing the steps described in the suggested action section. This typically involves replacing the physical component (for hardware faults) or reconfiguring and restarting the affected service (for software defects). Repaired problems no longer appear on this screen.

While the system typically detects repairs automatically, in some cases manual intervention may be required. If a problem persists after the affected components have been repaired, contact support. You may be instructed to mark the problem repaired. This should only be done under the direction of service personnel or as part of a documented Oracle repair procedure.

Related features

- A persistent log of all faults and defects is available under Logs as the **Fault log**.
- Faults and defects are subcategories of Alerts. Filter rules can be configured to cause the appliance to email administrators or perform other actions when faults are detected.

Logs

Introduction

Alerts

This is the appliance alert log, recording key events of interest during appliance operation. The following are example alert log entries as they would appear in the BUI:

Time	Event ID	Description	Type
2009-9-16 13:01:56	f18bbad1-8084-4cab-c950-82ef5b8228ea	An I/O path from slot 'PCIe 0' to chassis 'JBOD #1' has been removed.	Major alert
2009-9-16 13:01:51	8fb8688c-08f2-c994-a6a5-ac6e755e53bb	A disk has been inserted into slot 'HDD 4' of chassis 'JBOD #1'.	Minor alert
2009-9-16 13:01:51	446654fc-b898-6da5-e87e-8d23ff12d5d0	A disk has been inserted into slot 'HDD 15' of chassis 'JBOD #1'.	Minor alert

An info icon next to the Event ID means that extended information is available. Click the icon and this information will be displayed below the list of alerts.

The appliance can also be configured to send email, raise an SNMP trap, or perform other actions when particular alerts occur. This is configured in the Alerts section. All alerts appear in this log, regardless of whether they have actions configured for them.

Faults

The fault log records hardware and software faults. This is a useful reference when troubleshooting hardware failure, as timestamps are available for these hardware fault events.

The following are example fault log entries as they would appear in the BUI:

Date	Event ID	Description	Type
2009-9-5 17:42:35	9e46fc0b-b1a4-4e69-f10f-e7dbe80794fe	The device 'HDD 6' has failed or could not be opened.	Major Fault
2009-9-3 19:20:15	d37cb5cd-88a8-6408-e82d-c05576c52279	External sensors indicate that a fan is no longer operating correctly.	Minor Fault

Date	Event ID	Description	Type
2009-8-21 16:40:48	c91c7b32-83ce-6da8-e51e-a553964bbdbc	The ZFS pool has experienced currently unrecoverable I/O failures.	Major Error

These faults will generate alert log entries, and so will use the alert reporting settings (such as sending email), if configured. Faults that require administrator attention will appear in Problems.

System

This is the operating system log, available to read via the appliance interfaces. This may be useful when troubleshooting complex issues, but should only be checked after first examining the alert and fault logs.

The following are example system log entries as they would appear in the BUI:

Time	Module	Priority	Description
2009-10-11 14:13:38	ntpdate	error	no server suitable for synchronization found
2009-10-11 14:03:52	genunix	notice	^MSunOS Release 5.11 Version ak/generic@2009.10.10,1-0 64-bit
2009-10-11 14:02:04	genunix	notice	done
2009-10-11 14:02:01	genunix	notice	syncing file systems...
2009-10-11 13:52:16	nxge	warning	WARNING: nxge : ==> nxge_rxdma_databuf_free: DDI

Audit

The audit log records user activity events, including login and logout to the BUI and CLI, and administrative actions. If session annotations are used (see Users), each audit entry should be noted with a reason.

The following are example audit log entries as they would appear in the BUI:

Time	User	Host	Summary	Session Annotation
2009-10-12 05:20:24	root	deimos	Disabled ftp service	
2009-10-12 03:17:05	root	deimos	User logged in	
2009-10-11 22:38:56	root	deimos	Browser session timed out	
2009-10-11 21:13:35	root	<console>	Enabled ftp service	

Phone Home

If Phone Home is used, this log will show communication events with Oracle support.

The following are example phone home entry as it would appear in the BUI:

Time	Description	Result
2009-10-12 05:24:09	Uploaded file 'cores/ak.45e5ddd1-ce92-c16e-b5eb-9cb2a8091f1c.tar.gz' to Oracle support	OK

BUI

Use the Maintenance > Logs screen to navigate logs using list controls, and switch between logs using the local navigation buttons.

CLI

Logs can be viewed under the `maintenance logs` section of the CLI.

Listing logs

Use the `show` command to list available logs, and the timestamp of the last log entry:

```
caji:> maintenance logs
caji:maintenance logs> show
Logs:

LOG          ENTRIES    LAST
alert        2          2009-10-16 02:44:04
audit        42         2009-10-16 18:19:53
fltlog       2          2009-10-16 02:44:04
scrk         0          -
system       100        2009-10-16 03:51:01
```

Up to 100 recent entries for each log are visible using the CLI.

Viewing a log

Logs may be selected for viewing with the `show` command:

```
caji:maintenance logs> select audit show
Entries:

ENTRY      TIME                SUMMARY
entry-000  2009-10-15 00:59:37 root, <console>, Enabled datalink:igb0 service
entry-001  2009-10-15 00:59:39 root, <console>, Enabled interface:igb0 service
```

```
entry-002  2009-10-15 01:00:39 root, <console>, User logged in
entry-003  2009-10-15 01:41:44 root, <console>, Enabled nis service
entry-004  2009-10-15 01:42:01 root, <console>, Imported storage pool "pool-0"
entry-005  2009-10-15 17:56:30 root, <console>, User logged in
entry-006  2009-10-15 17:56:53 root, deimos.sf.fishworks.com, User logged in via
                               CLI
entry-007  2009-10-15 18:00:21 root, deimos.sf.fishworks.com, User logged out of
                               CLI
entry-008  2009-10-15 18:14:47 root, <console>, Browser session timed out
entry-009  2009-10-15 20:46:27 root, deimos.sf.fishworks.com, User logged in via
                               CLI
entry-010  2009-10-15 21:51:46 root, <console>, Rebooted appliance
entry-011  2009-10-15 21:51:46 root, <console>, User logged out
entry-012  2009-10-15 21:56:44 root, deimos.sf.fishworks.com, User logged in via
                               CLI
...
```

Most recent entries are displayed at the bottom of the list.

Entry details

All log entry details are available when selecting that entry and running `show`:

```
caji:maintenance logs> select audit
caji:maintenance logs audit> select entry-000 show
Properties:
                    timestamp = 2009-10-15 00:59:37
                         user = root
                      address = <console>
                      summary = Enabled datalink:igb0 service
                   annotation =
```

The "annotation" is the *session annotation*, which can be enabled when configuring users.

Glossary

7120	Sun ZFS Storage 7120
7320	Sun ZFS Storage 7320
7420	Sun ZFS Storage 7420
Active Directory	Microsoft Active Directory server
Alerts	Configurable log, email or SNMP trap events
Analytics	appliance feature for graphing real-time and historic performance statistics
ARC	Adaptive Replacement Cache
BUI	Browser User Interface
CLI	Command Line Interface
Cluster	Multiple heads connected to shared storage
Controller	See "Storage Controller"
CPU	Central Prcessing Unit
CRU	Customer Replaceable Component
Dashboard	appliance summary display of system health and activity
Dataset	the in-memory and on-disk data for a statistic from Analytics
DIMM	dual in-line memory module
Disk Shelf	the expansion storage shelf that is connected to the head node or storage controller
DNS	Domain Name Service
DTrace	a comprehensive dynamic tracing framework for troubleshooting kernel and application problems on production systems in real-time
FC	Fibre Channel
FRU	Field Replaceable Component
FTP	File Transfer Protocol

GigE	Gigabit Ethernet
HBA	Host Bus Adapter
HCA	Host Channel Adapter
HDD	Hard Disk Drive
HTTP	HyperText Transfer Protocol
Hybrid Storage Pool	combines disk, flash, and DRAM into a single coherent and seamless data store.
Icons	icons visible in the BUI
IOM	I/O Module; similar to a SIM
iSCSI	Internet Small Computer System Interface
Kiosk	a restricted BUI mode where a user may only view one specific screen
L2ARC	Level 2 Adaptive Replacement Cache
LDAP	Lightweight Directory Access Protocol
LED	light-emitting diode
Logzilla	write IOPS accelerator
LUN	Logical Unit
Masthead	top section of BUI screen
Modal Dialog	a new screen element for a specific function
NFS	Network File System
NIC	Network Interface Card
NIS	Network Information Service
PCIe	Peripheral Component Interconnect Express
PCM	Power Cooling Module, consisting of a PSU and one or more fans
Pool	provide storage space that is shared across all filesystems and LUNs
Project	a collection of shares
PSU	Power Supply Unit, included with fans in a power cooling module (PCM)
QDR	quad data rate
Readzilla	read-optimized flash SSD for the L2ARC

Remote Replication	replicating shares to another appliance
Rollback	reverts all of the system software and all of the metadata settings of the system back to their state just prior to applying an update
SAS	Serial Attached SCSI
SAS-2	Serial Attached SCSI 2.0
SATA	Serial ATA
Schema	configurable properties for shares
Scripting	automating CLI tasks
Service	appliance service software
Share	ZFS filesystem shared using data protocols
SIM	SAS Interface Module
Snapshot	an image of a share
SSD	Solid State Drive
SSH	Secure Shell
Statistic	a metric visible from Analytics
Storage Controller	the head node of the appliance
Support Bundle	auto-generated files containing system configuration information and core files for use by remote support in debugging system failures
Title Bar	local navigation and function section of BUI screen
Updates	software or firmware updates
WebDAV	Web based Distributed Authoring and Versioning
ZFS	on-disk data storage subsystem